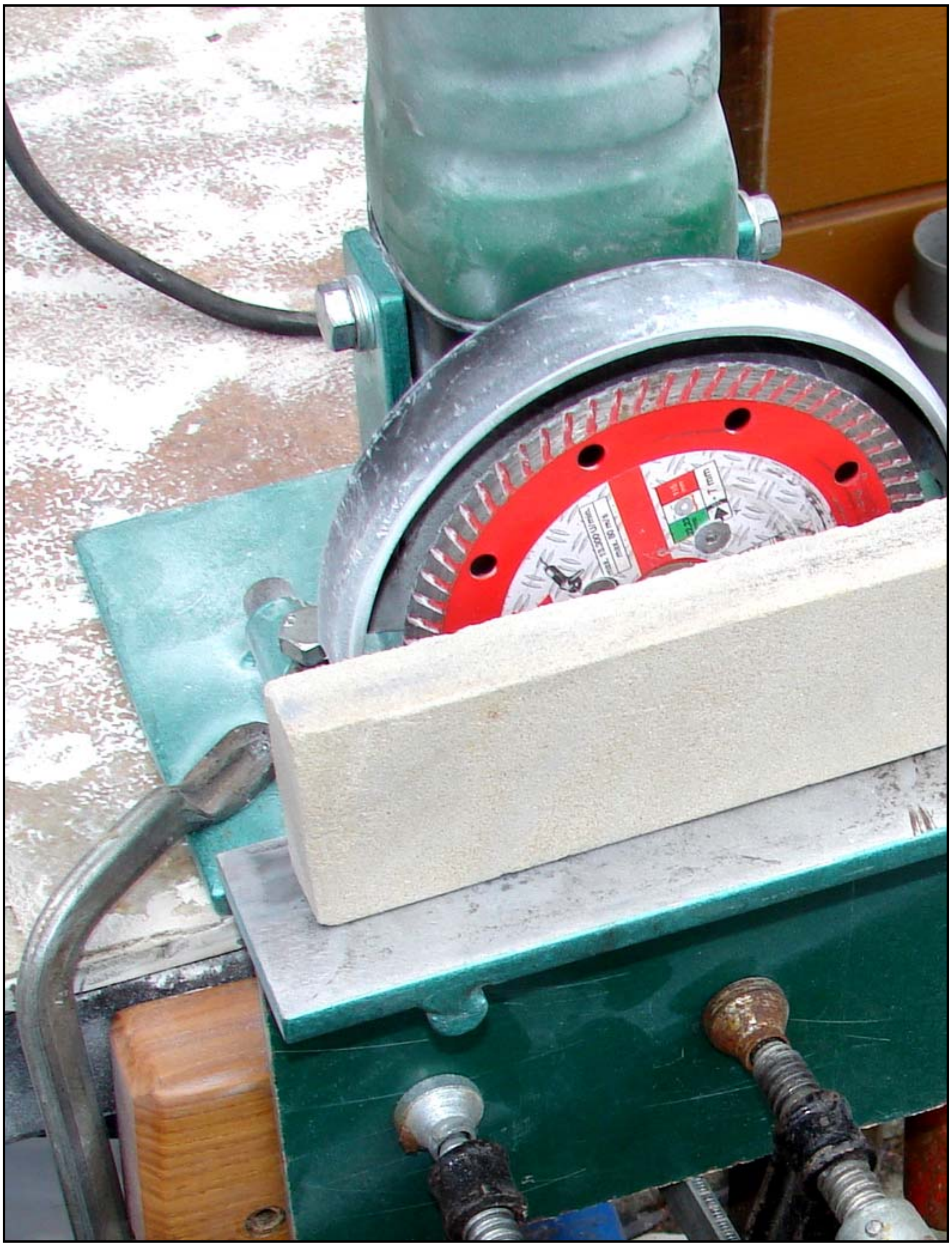


Foto: Henk Bos

Grinding and honing. Part 2

INFO 20M

Information for ship and tool-lovers

INFO 20M
Information paper great pleasure boats and toollovers

The paper "great pleasure boats" is meant for owners, skippers and other interested parties of recreational vessels over 20 meters such as:
- Former inland vessels
- Former Marine vessels
- Former fishing vessels
- Former Navy ships
- Former tugs and pushboats
- Houseboats
- Recreational vessels specifically built for that purpose.

The magazine INFO-20M "great pleasure boats" provides this target group with information about nautical law and the (technical) equipment on board the ship.

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- The Flemish Association for Water Sports (VVW)
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Other organizations may contact the publisher. Info 20M can also be downloaded through the website.

20M is a continuation of the series of information leaflets called M3-magazine, written in the period 1987 to 1995 for Scouting groups with a guard ship (a former barge used as a Scout clubhouse).
M3 magazine No. 1 to 20 can be downloaded via the index on the website (http://www.xs4all.nl/ ~ bds/m3-index.htm).

Introduction

One of the most important skills that a craft professional can acquire is the ability of quickly and properly use of grinding tools.
Using hand tools can be a frustrating experience, unless the tool is razor-sharp. The purpose of this part is to find the right honing stone that makes it possible to achieve very sharp tools in a consistent way. This requires knowledge.

The old knowledge is disappearing gradually and therefore should be available and accessible in a modern way.
This part is an attempt but nowhere near complete: that is not possible because it includes very many countries which languages I do not speak so I am not able to dig into the local craft history.

Maybe it's more a incites to encourage others to put down their knowledge about a craft on paper or electronically.
The purpose of this story is:
· Writing down the available information about natural honing stones.
· To give information to the starting professional about useful information, orientate and to be able to recognize stones in order to choose from the natural honing stones that are on the market, used and new.

Henk Bos

See for chapter 1 to 3:
http//bosq.home.xs4all.nl/info%2020m/info_20m-60.pdf
The cyan coloured parts will come in part 3.

Chapter 4 Types of natural honing stones
Definition stones 5, classifying stones 5, Igneous stones 5, Depth stones 5, flow out stones 5, Fission Rocks 5, difference in hardness 5, Sedimentary stones 5, Origin of sedimentary stones 5, Solid deposition 5, Granules 5, Less durable 5, Metamorphic stones 6, Origin of metamorphic stones 6, Structure and texture 6, Size of particles 6, Sandstone 7, Quartz sandstone 7, glauconitic sandstone 7, Psamnite sandstone 8, Arkos sandstone 8, Grain Shape 9, Slate 10, From mud to shale in 7 steps, Slate and size of grain 11, Slate and honing stone 11, Coticule 12, Novaculiet - (Arkansas, Charnley Forest stone, Turkey, Llyn Idwall) 14, Silica, Silicon dioxide 15, Flint 15, Chalcedony 16, Jasper 17, Jade 18, Beryl 18.

Chapter 5 acquisition of stones and then
* **Chapter 5a. Difference grinding**, polishing and honing
Classification to grain size 19, which stones can I use for what 20, classifying the grain size and use 20, acquiring (purchases) 20.

* **Chapter 5b. Designations of stone** 21, polishing stone 21, rectangular stone 21, Belgian stone 21, gully stone 22, Gillette stone 22, Gloss stone 22, milling stone 22, gauge stone 22, gauge honing stone 23, Holystone or Psalms book 23, Lithography stone 23, bench-hand stone 23, round bench-hand stone 23, slurry stone 23, knife block 23, multi form stone 24, oil stone 24, Roman honing stones 24, shale stone 24, straight razor hone 24, Razor stone 24, oversized rectangular stone 24, pumice 25, knife board or honing board 26, grinding stone 26, grinding files 26, scythe stone 26, gold proof stone 27, Water stone 27, honing stone 27, paint rub stone 28, Saddle form stone (also milling stone) 28, polisher 28.

* **Chapter 5c Historical finds**
Grinding and polishing stones for flint axes 29, making a flint axe 29, grinding stone of Slenaken 30, historical objects 30, Eidsborg stones used by Vikings 30, SO1 an early 17th century merchant ship in the Scheurrak 31, Coticule of more than 360 years old 31.

* **Chapter 5d Cleaning dirty stones**
Oil filled stones 32, salt 33, dishwasher tablets 33, other cleaners 33, surprises 33.

* **Chapter 5e Method to determine** what kind of stone
Determination of honing stones 34, appearance 34, texture 34, coarse or fine 35, sound 35, layering 35, colors and color patterns 35, slurry colors with a 'rubbing' stone 36, inclusions 36, density 37, hardness or scratch hardness 37, Testing hardness 37, Turners Sclero-meter 38, DIY 3 models 38, hardness of steel knives 39.

* **Chapter 5f. Lapping a stone**
Silicon carbide lapping plate by Norton and Nanima 40, diamond lapping plate and DMT Shapton DDLP duo sharp 40, a cheap way to plane honing stones with waterproof sandpaper 41, alternative method with a diamond lapping plate 41, lapping bridge 41.

* **Chapter 5g Lapping machine**. Bicycle wheel surface grinder. Lapping plate construction 43, grinding effect on a Rozsutec sample, sanded, coarse sanded C60, C90, C120, C180 and C220 42, C320, C400, C600, C800 and polished C1200 44. Lapping machine 2 47, Electroplated disc 48.

* **Chapter 5h. DIY honing stone**
Introduction 49, teaspoon 49, tools 49, method 50, fraction 50, lapping and square grinding by hand held machine 51.

* **Chapter 5i. Gluing**
Gluing broken and self made stones 53.

* **Chapter 5j. Water or oil**
Requirements for the liquid 54, water stones 55, oil stones 55, use of slurry 55, which oil 55, afterwards 55.

* **Chapter 5k. Cleaning, storage, boxes**
Making a box 56, glue 57, finishing 57, remarks 57, box models, on a plank 58, on a plank with laths 58, glued to a paddle 58, special boxes 59.

* **Chapter 5m. Database**
Why a database? 61, purpose of a database 61, which data are interesting 61, matrix 61, page from former database SRHDB, numbering of stones, material used to number, reproduction, position, practical numbering 63, practice 64, page from the database EU-stones 65.

*** Pgrit ruler 66.**

Chapter 6. Review of natural honing stones of Europe with 2-letter country code (according to ISO 3166-1).

Part 3 will come later. May be in 2013

Every country a map with deposits.

*AT Austria - Bergenzer stone, Gosauer stone.
* BE Belgium - Coticule, Belgian blue stone, Gres, Lorraine, Dressante, Veignette.
* CZ Czech. Republic - Piscovec, Bridlice, Marmor, Scythe stones, the sandstone, addresses.
* CH Switzerland - Ammergau.
* DE Germany - Bad Berleburg Mystery stone, Bergischer stone, Thuringer, Escher, Fasco, Franke, etc.
* ES Spain - Pedra das Meigas.
* FI Finland - Wästiki Oy, Testi.
* FR France - Saurat, Darney.
* GB Great Britain Charnley Forest, Novaculite, Cutlers green, Inigo Jones Dragon's Tonque, Tam O'Shanter hone works - found labels: Water of Ayer, Snake stone, Scots hone, Genuine Yellow Lake oil-stone, Dalmore Yellow and Dalmore Blue, Idwal, Lyn Welsh hone, Moughton, Llanbedr.
* GR Greece - Naxos, Kreta - Turkey stone (Petra Incognita).
* HU Hungary.
* IT Italy - Pradalung Pietri coti, 2 Medaglie, Green Dragon.
* NO Norway - Eidsborg Ragstone, Blautstein.
* SK Slovakia - Rozsutek.
* TR Turkey - Anatolia stones.
* SE Sweden - Gotland, Gränsfors, Limunda, Darlarna-Orsa.

Chapter 7. Specials - Non European

CA Canada British Columbia - Jade (6,5-7 Mohs).
US United States of America - Hindostan honing stone. Identifying, history of the stone, use.
US United States of America - Washita, Arkansas.

Chapter 8.

* 8a Abrasion test.
* 8b Identifying table.
* 8c Word index.



Below: A huge Arkansas. The carving is made of bone.



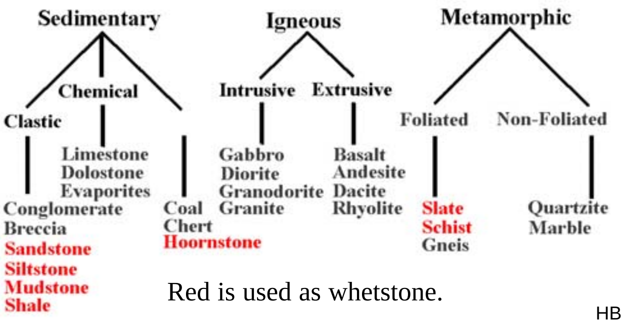
Chapter 4. Types of natural honing stones

In principle there are only three types of stone suitable to use as grinding stone, honing stone or polisher stone, provided the composition is right.
* Sand stone
* Shale
* Novaculite

All the whetstones consist of a very large part of quartz. Quartz is a form of silicon dioxide, SiO_2 and is among the most common minerals in the earth's crust.
The quality of a stone is determined by the grains-size, it's form and the binding between the grains.
We will see the effect in this chapter..

Definition Rock
"A mixture of minerals, developed in a natural way, that comes widespread and constitutes a part of the hard crust of the earth".
Rocks can exist of 1 mineral (e.g. limestone and marble that exist of the mineral calcite); or mostly from a typical mixture in certain proportions of 2 or 3 minerals, seldom more.
We know three kinds of rock, depending on how the earth has formed them.
* Igneous Rocks
* Sedimentary rocks
* Metamorphic Rocks

Classification of rocks



Red is used as whetstone.

Igneous Rocks

Origin of igneous rocks
Magma is the extreme hot liquid mass of silicates and oxides in the heart of the earth. Is there an eruption on earth? Then the hot mass cools and igneous rocks develop.

Three types of igneous rocks
* Stones from the depth
* Volcanic stones
* Fission rocks

Stones from the depth
The hot liquid magma forces itself into the hollow folds of the mountains. There it becomes hard stone.
These stones eventually come to the surface by levelling of the soil.
Stones from the depth have quite large crystals. Granite is the best-known species.

Volcanic rocks
The hot liquid magma paves its way to the earth's surface. It collapses and cools off quickly.
There rocks are formed. That happens for example in volcanic eruptions. The best-known volcanic rocks are porphyry, basalt and basalt lava.

Fission rocks
This rock stems from granite. A certain amount of molten granite separates and hardens in the magma and adjacent rock. This kind of stone is almost all used in the construction, for example of roads.

Difference in hardness
The slower the stone cooled, the harder it is:
Lava: this volcanic rock cooled off quickly. During the clotting process still pretty much gas escaped, hence the rough and airy structure.
Basalt: this stone cooled slower. You exceptionally will find another bubble.
Granite: this cooled extreme slowly, and that is why it is harder than basalt and lava.

Sedimentary rocks

Origin of sedimentary rocks
Sedimentary rocks come from other rocks or fossil plants and animals.
Parts continue to stay under ground after deposition.
This deposit is packed somewhere together or is deposited somewhere else, and it goes on lying there.
Here a new crystallization takes place under the influence of temperatures of 100 to 200 degrees.
Out of the ancient stone emerges a new stone: it is called sedimentary rock. This process is called diagenesis or rock formation.

Two types of sedimentary rocks
* Solid deposits
* Loose granules

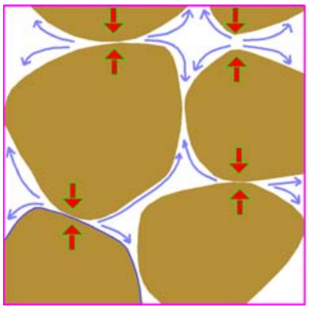
Solid deposits
This stones are found in nature in massive form.
These include shale, limestone, tuff and blue stone. Tuff is also called tuffiet and is composed of volcanic ash.

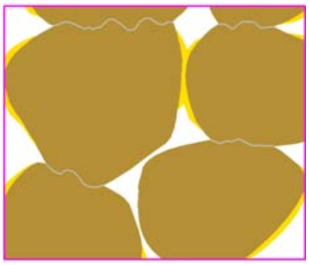
Granules
These rocks occur in a more granular form. These include gravel, reef lime-stones, peat, rock salt and dolomite.
Here was a chemical conversion.

Less sustainable
Sedimentary rocks are less durable than igneous rocks.
Therefore they are not resistant to harsh chemicals.
This is important to know if you want to clean your floor.

Metamorphic rocks

Metamorphic sedimentary rocks are caused by temperatures between 100 and 200 degrees.





The pressure of the overlying layers dissolves material at the places where grains are together.
This material crystallizes in the open pore space and works like a cement.
The result is that the rock becomes more compact and firm. In this way, for example, loose sand can change into sandstone.
Sedimentary rocks often are saturated with groundwater, which can dissolve and precipitate minerals.
The precipitation of minerals (cementation) causes the pore space in the rock to shrink.
Precipitated minerals form a cement that makes the rock harder and more compact. Loose particles in the sediment become like glued together by the cementation.
As sedimentation continues on top of a particular layer, the pressure due to the weight of the overlying sediments increases.
The rock is pressed together, a process called compaction. For example 60% of the pore space in clay deposits may be filled with water, this will partly disappear by compaction.
The compaction can be helped along by the process of pressure solution. It causes the rock to shrink by dissolving, while the dissolved minerals precipitate in the pores again.
It may also happen that a particular mineral originally present in the rock, will disappear all-together by dissolution in groundwater.
This process is called leaching.

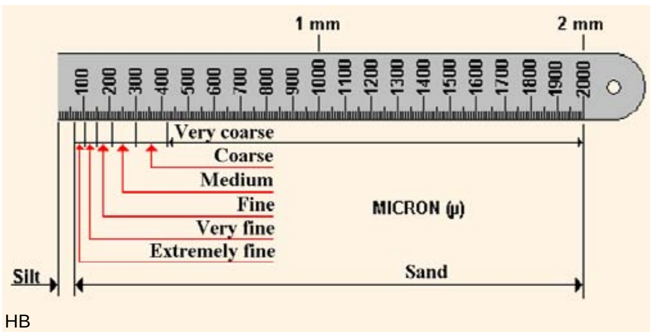
Origin of metamorphic rocks
If the temperature and pressure continue to increase, ultimately conversion of minerals into other minerals may occur. This is only possible in combination of very high temperature (above 200 degrees) and enormous pressure. The rock undergoes a new crystallization and changes in composition. These changes are not considered to be diagenesis, but metamorphosis. Rocks in which these reactions occurred are called metamorphic rock.

Loose rock	**Solid rock**	**Metamorphic rocks**
Gravel	Conglomerate	-
Sand	Sandstone	Quartzite
Clay	Shale	Slate
Lime or chalk	Limestone	Marble
Peat, lignite	Coal	Graphite
	Chert	Novaculiet

Structure and texture
If the structure of a recognizable metamorphic rock can be traced to its source rock, it is called a relict structure = palimpsest.
There also may be created entirely new structures, such as fission pressure and micro folding.
The minerals of metamorphic rocks undergo the transformation often under enormous orientated pressure. This gives metamorphic rocks often a special texture.
Shale is a fine-grained rock that easily can be split: the so-called shale-split. Shale plates are therefore applied as roofing.
Fyllite has a slightly coarse grain and it often has a silvery or greenish tinge on the pressure surface.
Schist is coarse-grained and is characterized by plate-shaped and stem like minerals. Often there are layers of quartz and feldspar interposed.
Gneiss is granular with distinct parallel structures.
Chert is fine. It has a smooth texture. It is caused by thermal transformation, in this case by contact metamorphism.

Grain size

Physical processes, such as the flow of water, determine the grain size. When the speed decreases the heavier parts sink to the bottom first. The lighter parts will still be transported and come down elsewhere.
In a solid rock, the diameter of the mineral grains is the average diameter of the mineral grains. The grain size is determined by the soil mass, in which moreover, sometimes can be quite large crystals.



* The rock is very fine, when the grains are not visible to distinguish to the naked eye. Than the grains are smaller than 0.065 mm. It is a microscopic rock. For whetstones this applies for instance among others to slate.
* In fine-grained rock, the grains can be seen by the naked eye, but not easily recognizable. The grains are larger than 0.065 mm. This is called a megascopic rock.
For whetstones these are usually sandstones.
* In coarse rock the mineral grains are not only well to see but also easy to identify.

A common format, somewhat reduced, in fractions is as follows:
Lutum   less than 2 mu
silt   2-64 mu.
sand   64 mu - 2 mm
NB. 1 mu = 1 micron = 1 / 1000 mm

Lutum actually is a better name for the group to 2 mu than the commonly used name clay. Clay is a complex loose rock that contains a certain amount of clay minerals, beside a large amount of quartz in the fraction <2 mu. In addition, clay contains granules in the silt fraction (2-64 mu) and a sand fraction (64 mu - 2 mm).

In order not to get lost concerning naming, you must particularly remember that names such as lutum, silt and sand are grain sizes indications. You must not be mistaken by thinking of the mineralogical composition. The name clay does say something about the mineralogical composition.

With Novaculite you cannot speak of grain size as the skeletons in the original material all are about the same size. For Novaculite the density is of interest.

Sandstone



Sandstone is a distinctive rock to nearly every one. As the name suggests, it is composed of sand grains cemented together. Already in the Stone Age sandstone was used as a hammer stone and polisher for arrow shafts.



In England it was formerly customary to practice shooting with bow and arrow after church time.
The arrows were sharpened on the sandstone door-frame (photo Llangar Eglwys church in Corwen Wales).
Since the middle ages, the rock is a very popular building material. In our country, sandstone is mainly found as a stray stone on the surface.

Sandstone is clastic in origin (as opposed to organic, such as chalk and coal, or chemical such as gypsum and jasper). It is a matter of time that sand layers in the soil are hardened into sandstone.
The sand grains may be packed together by silica, calcite, iron and even by clay particles. In most sandstone, the individual sand grains can be spotted by the naked eye.

Most sands consist largely of quartz. Does that mean that the original rock is also largely composed of quartz?
No, the reason that quartz is so common in sand is because it is a hard mineral.
While other minerals often are completely crushed up in transit quartz often is the winner and the only one left.

Other minerals that occur together with quartz, are distinguished:

*** (quartz)sand (stone)**



"Gildehauser Gold sandstein" by the Monseré company

Contains almost exclusively quartz (90%>).

*** Glauconite sand (stone)**
Contains the dark green clay mineral glauconite (a Fe-containing illite or smectite).
In Sellingerbeetse in the East of Groningen the substrate contains green sand. It owes its colour to the mineral glauconite, which is formed only under marine conditions. Probably were glauconite containing sands and clays from the Early Tertiary, from where the glauconite comes, that colour the sand green.

Examples: greywacke or blue stone.



Ruhr sandstone

*** Psammite: mica-containing sandstone**
By the perfect cleavage of the mica and the same orientation in sedimentation, these rocks will show a good cleavage according to the stratification.



Mica-containing sandstone

Very fine micaceous meld-water sand - America (Norg, Dr.). During the Elster ice age thick layers of fine, strikingly white coloured sand is deposited by meld-water. The sand shimmers because of the large number of small mica sheets. This sand, of the formation of Peelo, is won in numerous sand suction extractions in the northern Netherlands.



Main sandstone

*** Arkoze or arkosic sandstone**
Usely coarse-grained feldspar containing (25%>) sandstone. However, feldspars weather rather quickly to clay minerals.

Red-coloured sandstones owe their colour to hematite, an iron compound. Hematite forms a very thin skin around the individual grains, making it reddish in colour. Red sandstones occur mainly in dry climates, such as in deserts. If we find a boulder of red sandstone maybe we have a piece of rock in our hands that may be of Precambrian age, that came to existence some 1.5 billion years ago in desert conditions.

Especially hard minerals, such as quartz and feldspar, which are relatively resistant to erosion and weathering, build rocks. It has different colors and hardnesses depending on the sandstone composition.



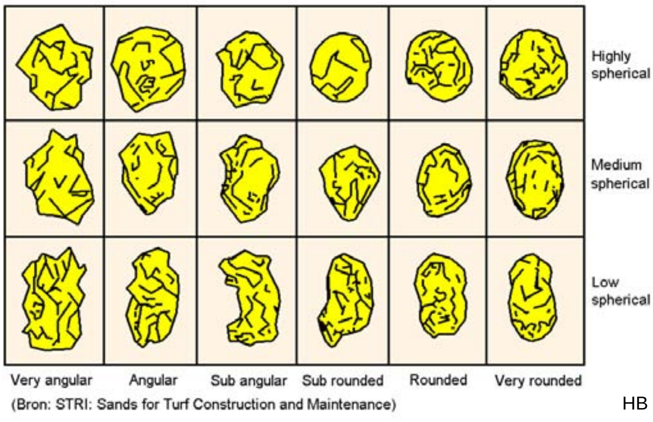
In general the sand grains cemented together form a homogeneous structure, but some sandstones have special characteristics. For example, some boulders of sandstone contain fossils, for instance shell fragments, or other evidence of life such as digging tunnels of worms.
Even sedimentary structures as flow ridges or layers are not uncommon. We can use the provenance of the very typical fossil content or sedimentary structures in a whetstone, to find out its origin.

There are many types of sand supplied by rivers.
Well-known examples are the fine-grained sandstone from the Devonian and Carboniferous, with characteristic fossils such as chonites, spiriferen and sea lily stems.



The Hindostan whetstone is beautifully layered and this is one of it's features. See: U.S. Hindustan whetstone.(Part 3)

Sometimes the laminar layers are beautifully, sometimes oblique or layered criss-cross.
The latter is found mainly in river sediments were it was deposited by ice or melt-water. Rapidly changing flow or changes in flow direction cause a "restless" sedimentation in the sand. Often the sand deposited by rivers is highly variable in size, as opposed to dune sand that is generally uniform fine grain.



For whetstones we want a small angular grain: small for the fineness and the angular for sharpness. Finding the optimal stone is a big job.

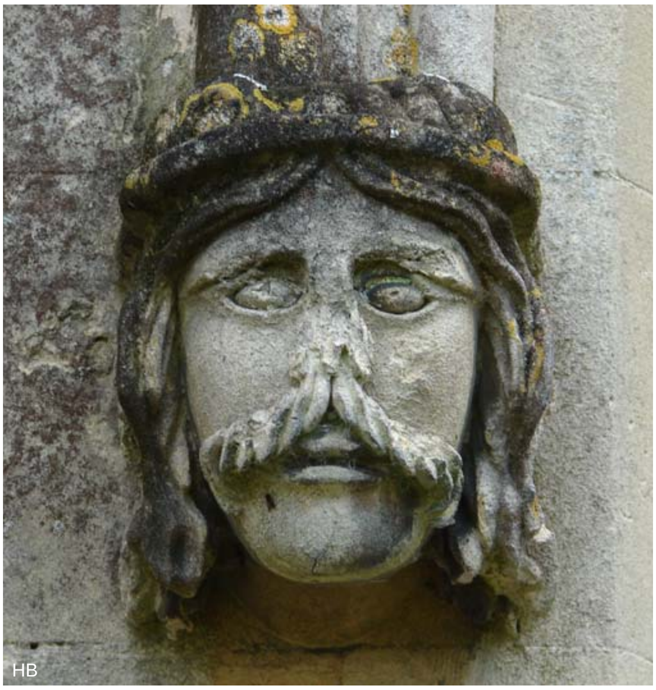
Some sandstone is resistant to weathering and is easy to operate. This makes sandstone suitable for building material and as a cope. Due to the hardness of individual grains, uniformity of grain size and friableness of its structure, sandstone is an excellent material for making grinding wheels for sharpening knives, axes and other instruments. Not friable sandstone is used as a millstone.



This type of grinder you see on many farms, especially in Eastern Europe. (Rucava Latvia)



An advanced version of a sand stone grinding-stone.
This is in the museum Morwellham Quay in Tavistock UK.



All Saints Church in Swindon Village, UK.

Slate

From Mud to Slate in 7 steps



1. The slip carried by a river is deposited somewhere in varying thickness and forms sediment. Particles smaller than 0.065 mm are called lutum (clay) and are clay mud. The particles are not arranged and are randomly mixed.
The mud is initially porous.
It is called clay when the lutum fraction is greater than 25%. In 25% to 35% lutum we have light clay, with 35% to 50% we have moderately heavy clay and when there is more than 50% lutum it is heavy clay. The lutum particles consist of flat plates on top of each other.

2. When the layer gets thicker, the underlying get pressed together making the random arrangement gets lost and the particles are approximately horizontal.
The water is squeezed out and stratification formed, the particles are still at random. Shale is formed.
Cementation ensures that the porosity of the rock decreases and density increases.
By closing up the pores the particles are "glued" together, the whole will form a solid rock. How quickly the cementation proceeds depends on the solubility of the mineral contained in the water.

3. Thickening of the upper layer causes lithification changing the sediment into bedrock. Physically lithification makes the porosity of the rock disappear by compaction and cementation.
The precipitation of cement glues as it were the clasts (clay or silt particles are clasts) in the rocks together, where the pores become filled up slowly.
Compaction (increasing the density of the rock) can occur because the clasts sit together closer. The clay mineralogy will change and the resulting rock is called **shale**. The rock is fissile.

4. The next step occurs in mountain building and early low-grade metamorphosis from 200 to 400 º C
(5 to 15 km depth). By tectonic forces the layers deform. The plates will rearrange and come perpendicular to the pressure direction.

There are many processes involved. The plates dissolve and deposited somewhere else and the rock transforms. First the shale is destroyed and then **argillite** is formed.
This is a fine-grained sedimentary rock with no clear direction of fission. In petrology (rocks science) the term "peliet" used is sometimes to refer to argillaceous rocks.

5. Then a new tectonic rock is formed with another splitting direction because the mica platelets are alignd perfectly.
We call the formed stone **slate**.
The rock is perfectly fissionable and is widely used for the production of roofing slate.

6. With increasing temperature the micas grow further now. Initially the stone retains its strong slate cleavage, but the cleavage planes get an increased silvery sheen by the grown mica. The resulting rock is called a **fyllite**.

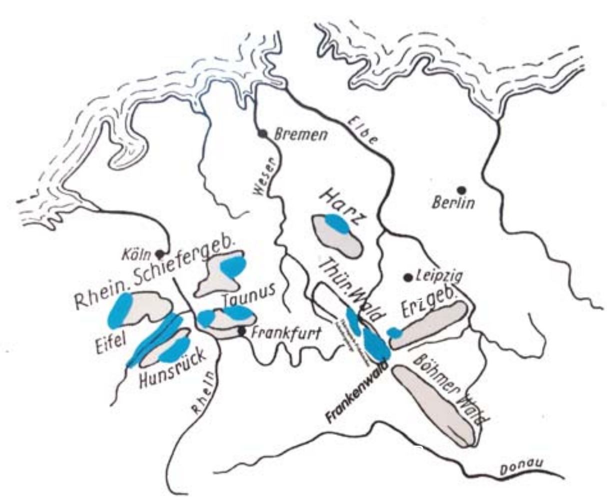
7. At even higher temperatures and pressures, the micas get even bigger, they are even identified with the naked eye and that gives the rock a crystalline character.
Schist is formed.

By the growth of mica and other minerals, the rock loses its characteristic slate cleavage.
This is replaced by an schistosity characterized by undulating, irregular cleavage planes.

8. Increases the metamorphosis even further, then a mineral segregation may appear to form a strong foliated crystalline rocks, which we call **gneiss.**

With a partial melting of rocks, anatexis is possible.
Distortion increases with depth significantly.
First appear whether or not symmetrical pleats.
Here the slate cleavage is in a relatively large angle to the stratification and both are easily recognizable.

Deeper the folds become more pronounced and highly asymmetric. Schistosity and layering are almost parallel. Ultimately, nothing of the original stratification can be found.



HB

German slate areas



Slate and grain size
In order to characterize soil types, we divide them into groups. Grain Fractions are grain groups whose largest and smallest diameter of each group is shown.
Internationally, there are no fixed rules for this.

The reason for this must be sought in the very different properties of the soil and the method of research; this is not yet uniform for the different places in the world.
Since the description of soil aggregates and soils often leads to 'confusion', it is desirable to provide an overview of some concepts and a soil classification of soils that are generally accepted in the Netherlands:

Lutumfraction	(clay) particles <2µ (= 0.002 mm)
Siltfraction or possible silty	particles <16 µ
Group lutum	particles <50 µ
Siltfraction	particles between <2 µ t / m 50 µ
Sandfraction	particles between 50 µ and 2000µ (0.050 to 2 mm)

We have seen that clay minerals, which form a large part of slate, contain a big part of chlorite causing the green colour. The clay minerals consist of aluminium silicates formed from the degradation of feldspar and mica during the natural weathering process.

The minerals are very soft viz. 2.0 to 2.5 on the Mohs scale. Other clay minerals that may be present either as primary or accessory minerals are illite, kaolinite and smectite. For example, in sea-clay dominate the clay minerals illite and smectite. Unfortunately, these are all soft minerals.

Furthermore we find in the minerals muscovite and biotite schist in the form of mica. Muscovite is usually white, colourless, brown, pink or green, while biotite is a darker brown. Micas are soft phyllosilicate minerals stacked in thin crystal plates. The thin crystals are easy to flake with your fingernail.

On the Mohs hardness scale mica is 2.5. Micas have a glassy luster, which means they have a shiny appearance. Quartz is the most abundant mineral in the crust.
Quartz schist has small, lens-shaped grains. Quartz is a hard, colourless mineral with a shiny gloss sometimes known as rock crystal.
It is the hardest mineral in slate with 7.0 on the Mohs scale. The grain size and the binding in the slate determines the quality of the slate when used as a whetstone.

Other minerals are common in slate, but are not required for their formation. Examples are hematite, pyrite, cordierite and andalusite, among others. Hematite is a gray to black iron oxide mineral with a red-brown stripe. Hematite can gif slate a brown to red colour by the iron content. Pyrite, or "Fool's Gold," is an iron sulphide mineral, and is a common mineral in shale. Cordierite and andalusite are respectively magnesium, aluminium and aluminium silicates. They are common in low-temperature metamorphic rocks like slate.



Slate as a whetstone
An indispensable natural abrasive. It is used in various forms in the market. It is used when there is a need for fine and sharp results. It has the great advantage that, like pumice can be filed in the desired form. Slate is a fine-grained, homogeneous rock with a few notable cleavage directions not formed by layers. In almost every country are slate whetstones made.
The result is a variety of sharpening stones with different qualities, texture and grain. Some names are Dragon Tongue, Thuringia, Lorraine, Rouge de Salm, and many others.



Coticule



Coticule is a yellow compact metamorphic rock consisting of a large number of minerals. Density is 3.22 g/cm3.
It occurs in layers of 2 mm to 25 cm. In the deep parts of the Basin of Vielsalm were in the Early Ordovician (about 480 million years ago) clay and silt deposited. Clay and silt have a grain size substantially smaller than the grain size of sand.
This deposition was supplemented with traces of iron and manganese, probably from volcanic activity.



It's hard to cut a whetstone from this.



Coticule alternating with shale is easier sawing.

Nearby was a shallow basin where remains of living organisms were deposited in the form of a calcareous layer. After demolition and various volcanic processes, the clay and silt layers alternate with the calcareous layers.
Pressure and temperature played a role in all kinds of processes in which water was driven off, and organic material containing manganese converted.
Later, when the rock was buried and was subject to compression during orogenesis due to plate tectonics they underwent a metamorphosis to 2000 atmospheres and 350 º C. During this process develloped spessartine, which eventually together with the other components led to the specific mixture of 1 / 3 part spessartiet [$Mn_3Al_2(SiO_4)_3$] supplemented with ceriziet and quartz which is so characteristic for coticule.

A nice piece 'Dressante' coticule



Coticule is found in a restricted area and is separated from its environment by two fault lines. On the fault lines the rocks have an age difference of 150 million years!



Spessartiet is named after the former location Spessart (GDR). This is a manganese-aluminum-garnet, orange to reddish brown in colour, hardness 7-7.5 and a specific gravity of 4.12 to 4.20 kg/dm3.

Cerizite consists of muscovite and paragoniet in a 2:1 ratio with the addition of 0-1% chlorite and 0-2% kaolinite.
For use as a whetstone, the tiny particles garnet (5-20 microns) are important. The particles are surrounded by quartz and mica. In hardness Garnet follows after Diamond, Corundum and Topaz.

Like a football, the surface is divided into facets (12 angles). It is its roundness with small towering points and hardness making the stone fit as a whetstone (see Part 1 Chapter 2 lapping). Due to the high hardness of the garnet particles also harder steel can be sharpened.





Ad Kox in Breukelen very many knives are sharpened!

Coticule grinds the fastest by using slurry. Wetting the stone causes this by rubbing over it with a 'milking stone or rubbing stone' over it in a circular motion. It is also ideal to keep the stone flat. Wetting the stone with saliva creates even faster results as this contains proteins that thicken when pressure is exercised. Former professionals often did this. The slurry contains loose garnets that get rolling as the tool is moved. The rolling motion removes very small pieces of material so the surface will become dull.
This also happens with other stones working with slurry. The grinding method is called "lapping", see Part 1.
A high gloss surface comes when the slurry is washed away and is worked on the wet stone. The method is now called sharpening.



Ground with coticule 'Dressante'





How often has there been spit upon?

Novaculite

From animal origin to stone
Deep water springs brought a lot of minerals on the surface of the primordial sea. The result is that microscopic animals such as glass sponges, diatoms, spongespicula and radiolarien (plankton) develop explosively.
If these die the skeletons drop down to the bottom, recrystallise and form a thick "bedded chert".



A fossil in a Turkish novaculite

Because how the stone is formed fossils are often found in the deposition.
The carbonates are chemically replaced by silica (SiO_2).
The color varies from white through light gray to black.
Chert is resistant to weathering. The white chert is of great purity and has a uniform grain size as the planktonic creatures are about the same size.

Chert is not limited to Oklahoma and Arkansas in America, it also occurs in Alounda on Crete, Charnley Forest and Llyn Idwall (Wales) in England.
The white chert (of high purity and a uniform grain size) is composed primarily of quartz and is named after metamorphosis Novaculite.

Metamorphosis into Novaculite
Nodular Chert is often associated with shallow water but by tectonic causes it can end up deep in the earth, where temperature and high pressure causes a metamorphosis.
As a result, the grains are pressed together in such a way that the spaces between the grains are no longer connected.

The stone no longer can absorb water. On the contact surfaces the material of the grains dissolves and crystallizes in the open pore space, and this holds together the grains as cement. The result is that the rock becomes solid and compact. The degree of compression ultimately determines whether it becomes a hard or a soft Novaculite.
This concerns the bond between the grains themselves.
The degree of compression increases the density (specific gravity).

Novaculite is extremely hard (Mohs 7). The colour can vary a lot from opaque, black, gray, white, yellow, brown, etc., all depending on the traces of spore elements.
Special is that it is not layered. Under the optical microscope or electronic microscope shows novoculiet a randomly oriented total of sharply defined blocks or polyhedral blocks or grains of quartz with smooth, lightly curved surfaces which somewhat resembles the air cells of foam.

One is inclined to trace quality to the colour what is not right. Better is to look at the density.
Quartz has a density of 2.65 kg / dm ^{3}. The density of Novaculite ranges from:



* Washita = Coarse 2.25 (grain effect 400 to 600),



* Soft = Medium 2.25-2.30 (grain effect 600 to 800),



* Hard = Fine 2.30-2.45 (grain effect 800 to 1000),



* True Hard or Black Hard or Translucent = Extra Fine 2.50 or more (grain effect 1000 to 1200).

Note 1: Washita is becoming rare!
Note 2: See also the Chapter determination.
The name Novaculite is derived from the Latin Novacula what means something like 'razor' or 'sharp knife'.



Note 3: The quality of Novaculite from America (Arkansas) is becoming less. When you want a perfect piece it is important to find a used one.





Cutting the pieces of Arkansas stone at Friedriech Müller.

Silica, Silicon dioxide (SiO2)
Sometimes I was asked why I look so extensively to the fracture surface of a sandstone. This is due to the influence of silicic acid on the binding of the quartz grains. Silica namely produces rock solid sandstone. This can be seen on the fracture surface. When knocking off a piece of rock the fracture goes through the grains, the rock is so hard that we are dealing with a non-metamorphic quartzite. The northern sandstones are often kwartsitis. Due to the hardness of the binding (matrix) these stones are not suitable for grinding. When the grains namely get blunt they will not break out of the matrix and the grinding effect stops.



In sandstone arisen through metamorphosis, the bond between the grains is weaker so the blunt granules break out and new abrasive grains are on the surface again.

Yet we can greatly benefit from silica in fine whetstones: we can use it for the last strokes to polish the cut.
The fineness can be very high.

Plants owe their structural stability to silicic acid and it is the second most common element in the earth's crust.
It is a trace element that is underestimated still too much. Silica has many names, also the names silicon, Silicea or diatomaceous earth occur. In nature it is never found pure, but always in combination with oxygen in the form of silicon dioxide.

For many plants and animals is silica an essential building material which ensures a stable form, such as the stems and leaves of horsetail or in the stems of the bamboo plant.



A Turkish novaculiet is similar to flint, and is brittle too.

When dying silicic acid is formed in combination with water. Silicic acid is a weak acid derived from silicon dioxide (SiO2). The oceans are full of it.

There many animals and plants use it in the construction of hard parts. It is used to make an external skeleton of it and that skeleton consists of insoluble silica. Silica is found in the structure of the smallest marine organisms, algae and diatoms, which already were present about 80 million years ago in the "primordial sea", the original ocean.

The skeletal structures of dead diatoms struck down on the ground and built huge deposits there. There are a few varieties of these deposits like novaculiet, chalcedony, jasper and agate. This material is suitable for an ultimate sharp knife cut, until mesh 10,000. Due to the fineness grinding (polishing) is very slow.

Flint
The difference between Chert, chalcedony and Flint is rather blurred. As a general rule we at first categorize rocks on the basis of what they are and not how they develop.

I like to use the term "flint" for the nodular shape (spherical) and the term "chert" for the rock-forming variety. In petrography the name Chert generally is used for stones that have their origin in microcrystalline, cryptocrystalline and microfibrous crystalline quartz. Quartz Magnesite does not belong in this line.



* Chalcedon is a microfibrouse (microcrystalline with a filamentous structure) form of quartz.
* Silex (= Flint) is associated in our regions often with chalk deposits and is characterized by a shell-shaped fracture. Flint is a rock that never occurs as solid rock, but only as inclusions in limestone.
* Chert (= ao Novoculite) however has its origin mainly in limestone and has a more straight (and smooth) fracture. Novoculite can occur in layers.

Flint is also called hornstone (English) or flint in French. The name flint is used for a group of stones whit whitch fire was beaten in earlier centuries. The sharp edges of broken flint make it perfect to use for objects with a sharp cutting edge.



Flint is a concretion of silicic acid (mineral group chalcedony) arisen underground under protracted pressure. The chemical name is Silicon dioxide ($SiO2$).



Flint is not a chemically pure quartz variety, it contains large amounts of impurities and the fine grain structure makes it boring and almost opaque. As Jasper it has a very irregular granular structure, while Agates - also a crypto crystalline quartz variety - consist of regular ingrown small quartz crystals.

Jasper is nearly opaque and usually the colors are more intense, while flint often is slightly translucent.
The size of the grains in flint is between 0.5 to 20 micrometers. Flint is a pretty hard material.
Actually pure flint (base material) is as transparent as glass, but contaminants provide coloration of the stone.
This is usually blue, blue-gray or black to white in color.
Resistant to 1700 ° C.

Chalcedony
Also called hornstone or chert is a silica rich, micro crystalline rock formed by metasomatism of sedimentary rock. In metasomatism a rock is not a closed system, in whitch the total chemical composition remains the same, but elements or substances from outside are added.
Usually this happens because hydrothermal fluids penetrate in the rock, in which elements or compounds are dissolved.
In metasomatism the rock itself is fully in the solid phase.
Hornstone may contain small fossils and can be white to black in color. Usually it is gray, brown, rusty red or light green. The color indicates the elements present, as red and green indicate the presence of iron.

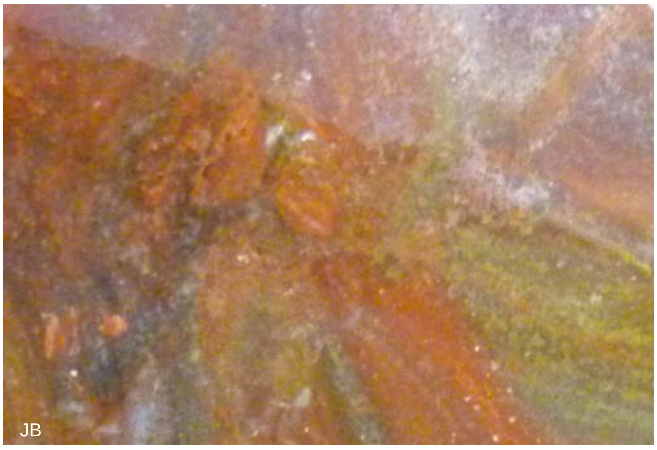
There is much confusion between hornstone, chalcedony and flint. In petrology the term "chert" is used generally to refer to all rocks composed of mainly microcrystalline, cryptocrystalline and fibrous crystalline quartz.
Because of the original silica chalcedony is one of the quartz family and has a hardness of 7.
Worldwide there is only one site where 1st quality chalcedony is found, this area lies in Namibia in Africa and is almost exhausted.
Other sites in the USA., Brazil and Turkey.

Chalcedony is usually found as filling of cavities and crevices, and there is often a crust around it. The stone consists of fine quartz fibers, which always are somewhat porous.

The white stone is translucent, while the gray and light blue type is opaque and shows light, clouded streaks.
The gem was named after the lost city "Calchedon" in Asia Minor and was already well known in antiquity, especially in Egypt and Greece.

The Egyptians were already at the time of the Pharaohs good cutters, engravers and sculptors. Their products, such as scarabs of chalcedony, are to this day still found during excavations. Scarabs are images of the dung beetle Ateuchus sacer, which were worn as amulets. In Tibet the white chalcedony is a symbol of the pure white lotus flower.

Jasper



Also in the formation of jasper water plays an important role. Jasper is therefore mainly found in hydrothermal veins (veins of hot springs or geysers) or in cavities of volcanic rock. Quartz is difficult to dissolve in water, but the silicon that is stored in other minerals such as feldspars and micas, can be dissolved in hot water. Then it becomes silica or silicic acid. The water flows through cracks and tunnels in the ground. If the silicic acid can no longer be maintained in solution, because the temperature is too low or the concentration of silicic acid too high, the water rich quartz starts to precipitate. Usually, a type of gel is formed first. If more water evaporates, jasper or flint arises from the gel.

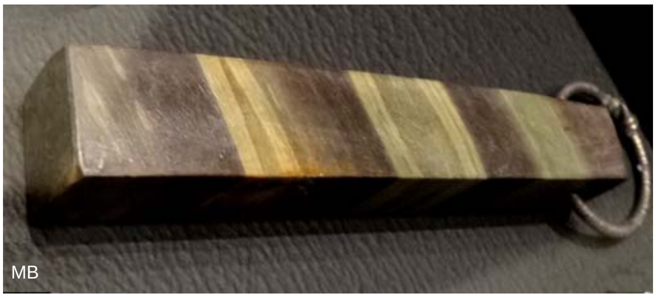


Jasper can also be formed secondary. Then it replaces an original rock, molecule by molecule. Petrified wood is converted in this way into jasper or some other form of quartz.



Jasper Plate - a whetstone with a very fine grain

Another secondary formation of jasper can occur in some organisms that make skeletons of silica, such as sponges, diatoms and radiolariën. When they die, silicic acid can be converted into a form of micro-crystalline quartz, such as jasper.



In Viking times, small jasper whetstones often were worn as pendants because they were usually very nice to see.



Jasper whetstone of a small size. Were often found in a sewing basket or box and used to sharpen the point of a needle.



There are many pendants found in tombs and shipwrecks. Jade whetstones can not sharpen a knife but by their fineness can bring the sharpness of a knife to a much higher level.



Slate counterpart of the format that is often worn on the belt. The dimensions are approximately 75 x 25 and 12 mm thick.



Jade



Nephrite a Na-rich pyroxene (jadeite) whetstone with a very fine grain. Nephrite is stronger (200 MN/m2) than jadeite (100 MN/m2). Hailing from British Columbia. There are 15 quarries known. It is the best quality available in the world.

There are two versions namely green jade (jadeites) and nephrite jade.
The particularly rare and expensive jade green can have a hardness of 8 or 9, which corresponds to sapphire / ruby, aquamarine, spinel and topaz. Because of this hardness Jadeites are invulnerable to steel and cutting tools made of carborundum.
It is very difficult to work and therefore it is likely that many early cultures this material appreciated: it proved an ideal material for weapons and tools out of it. Green jade has a smooth, shiny, glittering and translucent surface. In green jade beads are virtually invisible.

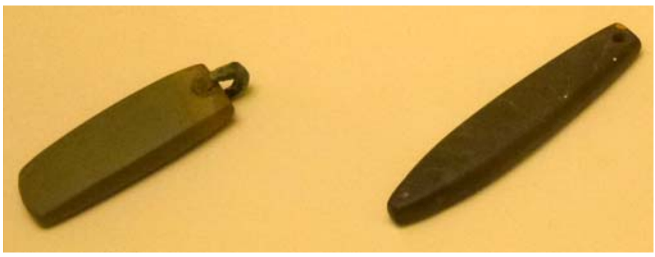
Nephrites have a hardness of about 6 - 7 or lower, and can be cut easily and therefore the commercial value is much lower than jadeites. Chemically, nephrite jade consists of a mineral called actinolite, a mineral with high proportions of magnesium and calcium.

A plate of Jade for a whetstone to a sufficient size can be purchased from mineral stores. First take the stone in your hand and inspect it thoroughly with a loupe before purchase. Tip: Test the stone by rubbing a teaspoon over it and watch the grinding marks. Hopefully they look like polished.

Beryl

Beryl is a mineral and belongs to the group of aluminum silicates. It is a colorless, white, yellowish white, yellow-green to green, pink, bluish to greenish blue, red or gold beryllium aluminum silicate. The chemical formula is $Al_2Be_3Si_6O_{18}$. The hardness of the mineral is 7.5 to 8 on the Mohs scale (brittle) and the stripe color is white.

The mineral, which occurs in crystals, granular, or compact radial aggregates or gravel is transparent to translucent and has a vitreous, dull finish. The density of beryl ranges from 2.63 to 2.80 and it has a hexagonal crystal structure.
The hexagonal crystals of beryl can be very small, or up to one meter. There is no mention of the smallest known particles measured. Provided the piece has very small granules it is good to use as whetstone (polishing stone) but you will have to look at the stone very well. Fortunately there are many alternatives. Broken crystals are relatively rare. Pure beryl is colorless, but it is often colored by impurities; possible colors are green, blue, yellow, red and white.



Pendants from the time of the Phrygians. Who had had a state near Gordion (Turkey) and migrated from Macedonia to Gordion in around 1200 b.c. The stones have been found during excavations of the city and of the burial mounds.

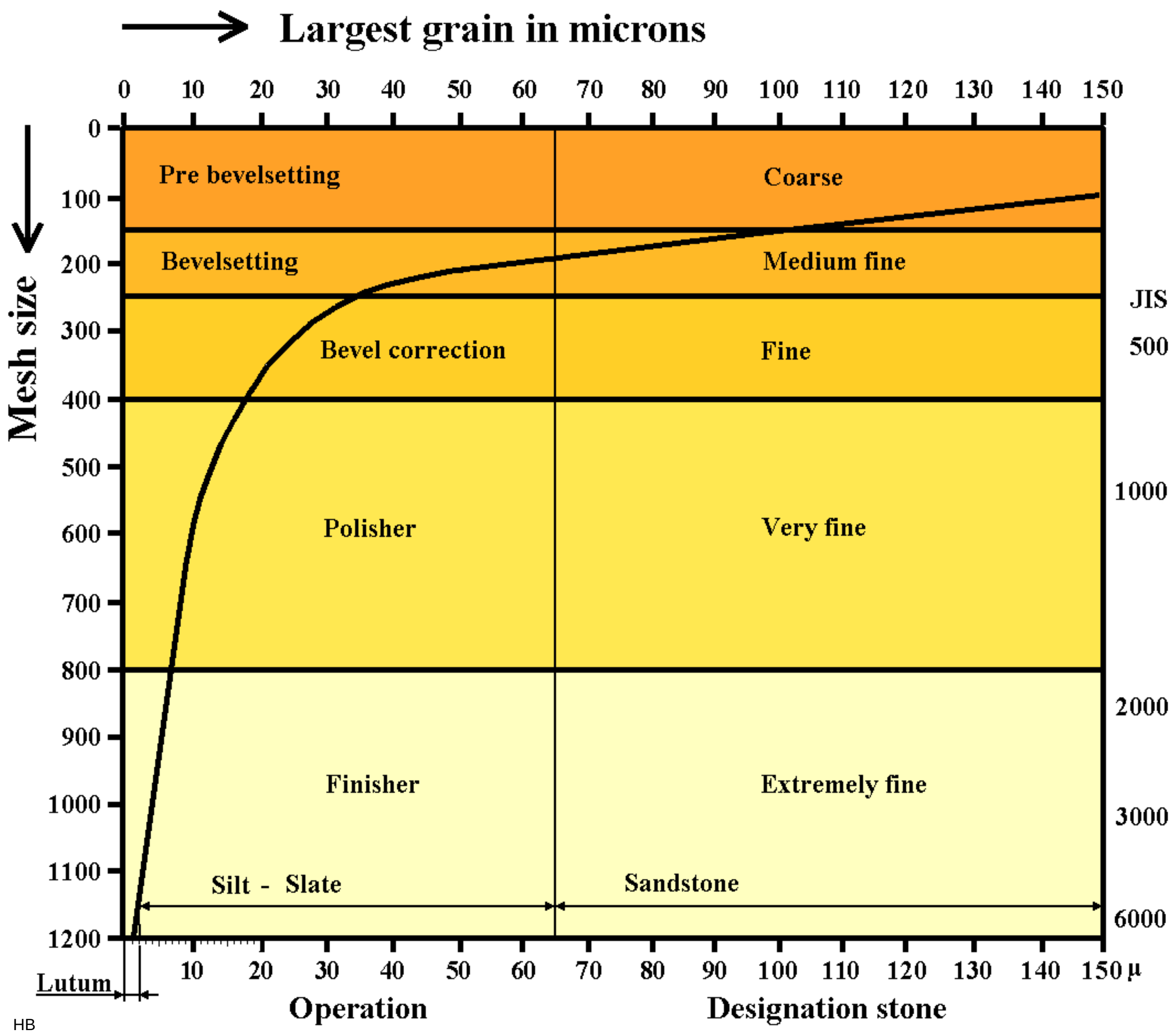
Chapter 5. Difference grinding, honing and polishing

Classification
For whet and grinding stones we can distinguish three main groups, namely: sandstone, shale and novaculite (Arkansas). For our purposes, the stones have a very fine grain with a uniform grain size.
With fine-grained stones the grains can be seen with the naked eye, but are not easily recognizable. Then the grains are larger than 0.065 mm. This is called a megascopisch rock. Then we usually speak of grinding stones and these are mostly sandstone.
If the grains cannot be distinguished with the naked eye we call them whetstones. The grains are smaller than 0.065 mm. It is a microscopic rock. In whetstones this is usually slate.
Geologically the format of the grains usually is used in fractions. Somewhat shortened it is as follows:
* Sand 64 mu - 2 mm;
* Silt 2-64 mu;
* Clay less than 2 mu.
NB. 1 mu = 1 micron = 1 / 1000 mm.

The yellow Belgian coticule has an average grain size of about 1.2 microns and is in the Lutum part of the drawing.

What stones you need depends on the application of grinding, sharpening and honing stones. On the Internet a lot is written about it and as usual the opinions are quite different.
This is usually due to the fact that the authors rely on their own set of stones they have good experiences with. It will become even more complicated when it comes to what stone can be used for which application.

The shape of the grains also plays a major role. Silicon carbide is very sharp in shape, removes well and quickly but gives a rough surface.
Corundum gives a smoother surface while quartz gives an even more smooth surface. Coticule with emulsion gives a matt surface and with running water a glossy surface.



Which stones can I use for what?
First, determine what you are going to use your grinding or whetstones for. Sharpening wood chisels, knives and razors goes in the same manner; only the cutting angle is different.

Practice this as much as possible. Start with an artificial stone such as Norton 4/8k (14 and 3µ) until you have mastered grinding and honing. Then you can refine the technique and results with a natural stone.
There are many stones that qualify, as Belgian yellow coticule, German Thuringian and some English stones like Dragon tongue, Charnley Forest and the Tam O Shanter family. The Japanese stones are a risk best to be avoided.

Grinding
For molding or to remove signs of damage from the cut, a stone of 120 (122µ) is a good choice.
Then to refine the cut usually a 320 (50µ) stone is used.
For further refinement, there are quite a few possibilities.
For the final polishing in the correct form of the cut I usually use a stone with a grain around 600 (24µ).

To refine the surface further and to polish a grain of 4k (14µ) and subsequently the 8k (3µ) is a good choice.
At the top there is really no limit. It depends on the purpose, energy and money you want to spend.

Classification by grain size and their use
(See Part 1 page 14 to compare grain seize)
P 8, 10, 12 Very large, suitable for grinding.
P 14, 16, 20, 24 Coarse, suitable for grinding.
P 30, 36, 46, 50, 60 Coarse, suitable for general use.
P 70, 80, 90, 100, 120 (200-125µ)
Coarse, for regrinding and pre bevelsetting.
P 150, 180, 200, 220, 240 (100-45µ)
Very fine, suitable for polishing and bevelsetting.
F 280, 320, 400, 500, 600, 800, 1000, 1200 (36-3µ)
Extra fine, suitable for fine polishing and finisher.

The acquisition

Many begin by stumbling across a whetstone. This may be through an inheritance or a flea market. I personally gained a lot of stones on the Black Market in Beverwijk.

You find one and think "eh that is interesting" and you are lost. Later, you determine what you bought and then it can be fine or, what also occurs a disappointment.

A safe way is to buy a stone from a reputable dealer who has knowledge of sharpening stones and uses them himself. Some well known examples: Neil Miller and Maxim.

Another safe way is to buy a natural stone at the manufacturer. In Chapter 6, there are described several, often with a wide range.

Some examples: Maurice Celis of Ardennes Coticule
http://www.ardennes-coticule.com/index.asp?intro
Jan Marek http://www.cestadreva.cz/,
Inigo Jones & Co. Ltd., Tudor Slate Works, Y Groesion UK
http://www.inigojones.co.uk/products/Honing-Stone.php
and many others.

A less secure way is to buy a stone in a second hand tool market. They often have stones but do not know what they have. For this you will have to gather knowledge yourself. There are many beautiful stones but the risk of a bad bargain is great. Note the weight. Artificial stones are much lighter than the natural stones.

Buying on E-bay is a quite unsafe way.
Someone, living in England, bought in this way the most expensive brick ever!
Many also use the wrong name for their offer. Therefore:
1. Always contact the seller and ask questions about the stone you are interested in.
2. Ask for better and sharper images with accurate colour reproduction. On blurred images many stones look much like an Arkansas while they are not. Often the photographs show another stone! A green Washita or a red Tam O Shanter does not exist.
3. Do not buy Japanese stones when the seller does not guarantee the proper fineness and quality.
4. On Japanese stone you cannot read the hallmark and that is a risk.
5. Make sure the vendor understands what he's selling. Sometimes a synthetic stone is called a natural stone.
If the seller says he does not know what it is, it's a synthetic stone.
6. Used stones are used and therefore they will show traces.
7. Always ask for the opportunity to undo the sale. Often a polishing stone is offered with which it is impossible to polish a cut.
8. Some stones are a hype. Some examples: Charnley Forest, Escher and the Frictionite barber stone. There have been paid very high prices while there are many good other alternatives.
Often a combo coticules is called Frictionite hone.



The prices of Charnley Forest sharpening stones can be far apart. The cheapest you'll find in the area around the finding spot where the supply far exceeds demand.
On eBay the prices also can be far apart. A UK auction of an oil-covered CF in the tool category will cost a little.
In a U.S. international auction a cleaned and flattened CF with a clear red / green pattern in the razor category will be many times more expensive. The real value is difficult to determine, but with the necessary patience there is a lot to save.

Designations

Probably someone ever picked up a boulder and found the form was well suited for the function as grindstone.
For example, shale: a fine-grained, tough stone, which is ideal for sharpening metal. Whetstones are timeless.
They are known from the prehistoric and medieval times, but also much later, and therefore are difficult to date.

Research found no clear preference for stone type concerning knock, rubbing and grinding wheel stones.
For the pounding of spices and grains knock stones from sandstone, quartz or granite were often used alike.
Fortunately, an increasing amount of information is available on the Internet so you yourself can do research.

Rubbing Stones are because of their granular structure most of granite, but often a gneiss or sandstone was used for it. Much less frequent is the use of Gabbro's (the igneous rock Gabbro is a stone from the deep with between 48 and 52% silica) or diabases (dolerite igneous rock), although in principle, they are suitable for it. It is possible that these stones were avoided or less collected because they are relatively heavy.

The distinction between grinding and sharpening is often gradual. Some stones combine both functions. This we see regularly with gneiss (metamorphic rocks with a striped appearance). The grinding and shaping of iron objects was preferably done on slightly coarser grained stray stones that takes away good. Grained sandstone was preferred.

Sharpening and keeping knives, daggers, swords and other equipment sharp was done on whetstones. These are in most cases tools to be used by hand. The fine-grained rock types were preferably used for this finer grinding.
Mostly, these were fine-grained sandstone, but also often fine-grained gneiss (leptiet), amfibolite, and hornblende schist, in some cases even fine-grained granite and hell flint.

Both the flat sides and the edges of the stone were used for sharpening. Caused by use the edges often have a characteristic ingrained, undulating course. Slightly elongated whetstones are often worn saddle-shaped.
Moreover both surfaces and the edges feel "smooth".
The wear marks on the stones are often so familiar that grinding stones and whetstones are fairly easy to distinguish from each other.

There are lots of names in use. The following list is not complete but will give an impression of the most common names.

Note:
For orientation in the following section we use sometimes the Dutch name and a possible English translation.

Aanzetsteen ook Zetsteen - Whetstone.



1) Whetstone. Although chisels are made of hardened and tempered steel, they wear in use. Proper maintenance of the tool is necessary. In normal use, occasionally simply use a fine stone or a sharpening steel for the blades.





2) In addition to a sharpening steel there is a ceramic version.

Banksteen - Bench stone



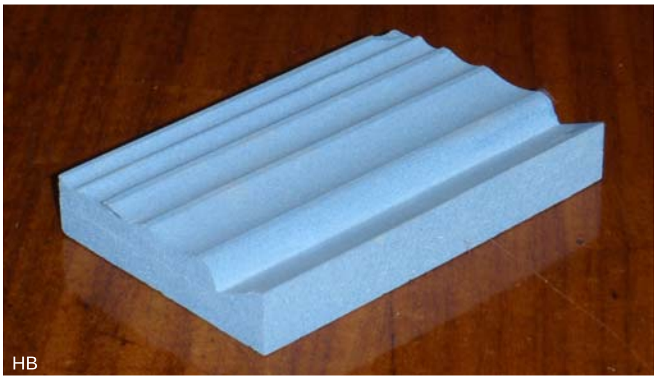
Rectangular stone usually in a box used to sharpen chisels on a workbench. The name is also used for other rectangular grinding- and whetstones.

Belgisch brok - Belgian brock



1) Traditional a Coticule yellowish stone with 35-40% garnets. Because this quality is rare and precious, it is cut as multi-perspectived forms (brocks) from the mined rock and to reinforce bonded on a layer Portuguese slate.
The natural combination stone (combos) have become very rare.
2) Kits stone (dialect). Kits is another word for saliva.
3) Slip Stone (dialect) grinding stone.
4) Kits Rock - Frisian slang for a Belgian Brock.
5) Whet boulder - slang used in the province of Limburg (Neth.) for whetstone.

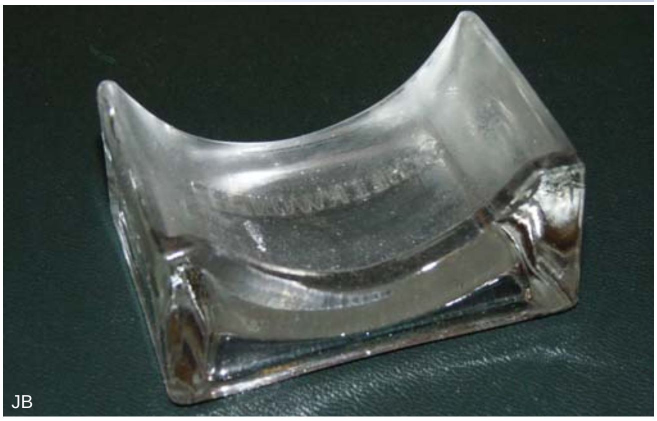
Geulsteen - Trench stone



Usually artificial, side by side multi-ply.

Gillette stone / glass





In 1903, eight years after Gillette had the idea and two years after he obtained a patent, the Gillette Safety Razor appeared on the market. The Safety Razor was to be maintained carefully like an open razor.
In poor times hollow sharpening devices were on the market, usually made of Coticule or glass to polish Gillette razors for reuse.

Glanssteen - Gloss stone



© OHK1209 gloss stone length: 15.2 cm diam.: 3.6 x 3.6 cm.
Black lydiet. Round ends. 1750 (18th century).
Used in the weaving house for smoothing linen.
www.oudheidkamertwente.nl

Round or oval (sometimes rectangular) stones, mostly small stones from which a portion is flattened so it is rounded rectangular or oval to planoconvex. The stones are polished and served as an iron. They occur in quartzite and lydiet. They also come in glass, the so-called ironing glass, gloss or grittel (dialect from the province Overijsel) stone.
In later days they were made of glazed earthenware and sometimes came with a sausage-shaped handle, which is evolved into the modern iron. In museums they often bear the name grinding stone.

Maalsteen -Mill stone



© Rijksdienst voor het Cultureel Erfgoed, afdeling Scheepsarcheologie, Lelystad

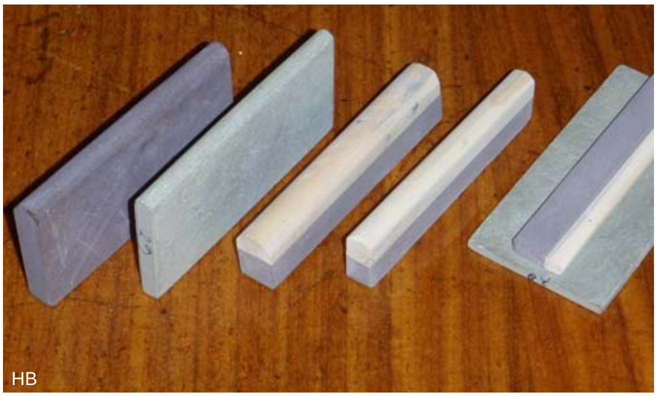
A man-made tool, usually made of stone, with the aim to reducing, grinding, disintegrating and / or pulverizing any material before it is processed into finished products.
A rectangular version is often mistakenly called grinding stone. Also called grain crushers. On this stone probably the corn ground was into grits or malt.

Gutssteen - Gouge Stone



Usually round bar-shaped stones that can be used for inside sharpening of a gouge.

Gutswetsteen - Gouge whetstone



A rectangular stone with a rounded edge.

Holy Stone Book or book of Psalms



A stone (sandstone), with which they scraped the wooden ships decks on their knees. It had the form of a psalm book; or as the English say a holy stone. A heavier "book" (about 25 pounds) was equipped with a bracket and a handle.

Lithosteen - Lithographic stone



Used for Lithography (Lithos = Stone and grafein = draw / write, and it stands for lithography.) Rectangular chunk of a special rock, with one smoothed side to which an image is drawn or painted.
The print of it is a lithograph. In late eighteenth century Alois Senefelder discovered lithography. He wanted a more appropriate way to reproduce music. Apparently the gravure / engraving did not produce the right print for the job that he had received. After many experiments, he finally tried limestone.
Coincidentally, he was a resident of Bavaria, southern Germany, where in the form of Solnhofener limestone 'pure' limestone was available. The limestone is too soft to grind or whet.

Machine stone



A round, in this case artificial corundum sharpening stone used in machine technology. Similar to the stone used for axes. The name is also used for a circular grinding wheel for a grinder.

Machinistensteen - Engineer's Stone



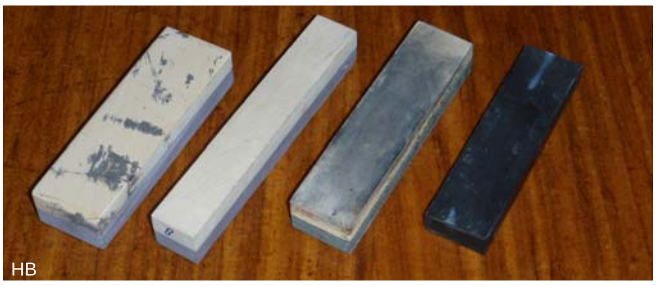
Term translated from the English for a fine-grained silicon carbide oil stone as used by locksmiths.

Melksteen - Rubbing Stone



Slurry stone, used with slate to produce a "milky" grinding paste that gives a fast result with a dull surface as a result.

Messteen - Knife stone



Short and narrow stone easy to carry and used to sharpen a (pocket) knife.

Multi-Shape Stone



Stone used for the sharpening of the profile on the inside and outside of gouges and burins.

Oil Stone





Usually artificial stone with an open character so the stone can absorb the oil.
The Hindustan and some Washitha's also take oil.

Roman whetstones





Shale stone



Another word for slate. Some types of slate can be used to make very fine sharpening stones.

Scheermessteen - Razor stone



The word Novaculite comes from the Latin word novacula, meaning razor stone. Also coticule - coticula stone, pierre à rasoir, affûter aiguiser.

Scheersteen - Shaving Stone



1) Alum 2) Alum Rock 3) Alunite

The best known application in daily life of every man when alum was used on the sink. Men who had a cut while shaving used it as an astringent. Alum binds to proteins in case of damaged skin and makes it contract (astringent effect) so the bleeding stops.

Schuifsteen - Slide Rock

1) Stone flattened by water transport. It is rare and with the right fineness of grain can be used as grinding stone or whetstone.


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2) Is in one way or another the edge of a chisel got blunt, then it is sharpened on a sandstone, which grit may be not too fine nor too coarse. Sometimes a sliding stone is used instead of a whetstone. Sliding stones usually have a more or less rectangular shape. They can be purchased at a hardware store, but usually one can get a discarded piece of a grinding stone at be a carpenter.

The tool must, by adding water, slid back and forth over the sliding stone. To avoid unpleasant movements of the stone, one will do well to secure the stone in place on a self-made tray, while taking care that the stone protrudes above the shelve. From: Fix yourself but do it right! Bernard Weickmann May 1944.


HB


HB

3) The blacksmith used it during the hardening of tools. The work-piece is heated and then the cut is cooled. The piece is then sanded clean on a slide rock, so the heat of the work-piece moves to the edge. The initial colours become visible. With the right colour, the cut and the work-piece are cooled and get their final hardness. Note: We used the edge of the sandstone tank to remove oxide. The water tank clearly showed tracks of wear.

Schuursteen - Rubbing stone


HB

1) Pumice, was used while painting



2) Abrasive. A rubbing stone is used when sculpting and takes the shape of the object to sand. Size usually is 25 x 50 x 200 mm, weight about 500 g. Available in 36 grit, 60, 80, 120 and 220.

3) Used to remove a stain on cement screeds and sanding equalized screeds. A 50 mm thick stone grit 36 is used to manually update concrete tile edges.

4) Also used in a historical technique of brick work. By cutting, smoothing and sanding bricks were placed precisely to tailored intricate patterns and ornaments in bricklaying. Characteristics are the very thin joints that have arisen in the work.
5) Its use also includes the sanding of a crepes griddle surfaces.

Slijpplank ook Wetplank - Grinding or Whet shelf



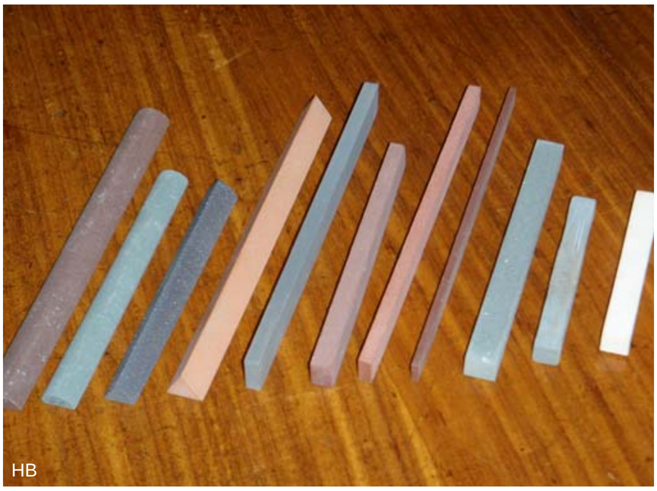
Shelf on which (in domestic use) a knife could be sharpened with sand or a sharp powder. See: [http://bosq.home.xs4all.nl/info% 2020m/info_20m-60.pdf](http://bosq.home.xs4all.nl/info%2020m/info_20m-60.pdf) page 22-24.

Slijpsteen - Grindstone



A grinding wheel is a stone-like material to grind or sharpen tools, or to grind anything.
A grinding wheel can simply be a sandstone, for example Bentheim sandstone, on which knives are sharpened.
Often it is a circular disk, which must be rotated by hand or is used in a grinder.

Sharpening Files



Sharpening files are regularly used by both the jeweller and in machine technology. They exist in natural materials and ceramics made of corundum and silicon carbide.
A set consists of coarse, medium and fine in square, triangular, circular, semicircular, 6 x 100 to 20 x 200 mm.

Strickle, also: hottefyle, meel, pikstrik, strijklat, strieker, strieklat and bow



1) A strickle: lath pasted with a coarse abrasive material. Previously, the sand used for the lath was glued to it. Sometimes the manufacturers painted the sand. Today silicon carbide is generally used. Is known by many names.



2) Hottefyle - Frisian Dialect. The "hottefyle" was the predecessor of the "strickle" and thus the tool to sharpen a scythe.



3) Meel: Dialect from Brabant. In order to sharpen the scythe, the scythe was being 'gehaard'. Then de farmer tapped it with the so-called "haar hammer" on the edge of the scythe lying on a small anvil, called "haar crown". The cut of the scythe became in that way as thin as possible, so the strickle (the so-called "meel") could be used well. Then the scythe became sharp and mowing could be done. This "haaren" of the scythe had to be repeated several times, otherwise the cut became too thick and the scythe did not cut properly.

4) Pikstrik: Dialect from Drenthe. The strickle was used to keep the blade of the scythe sharp.



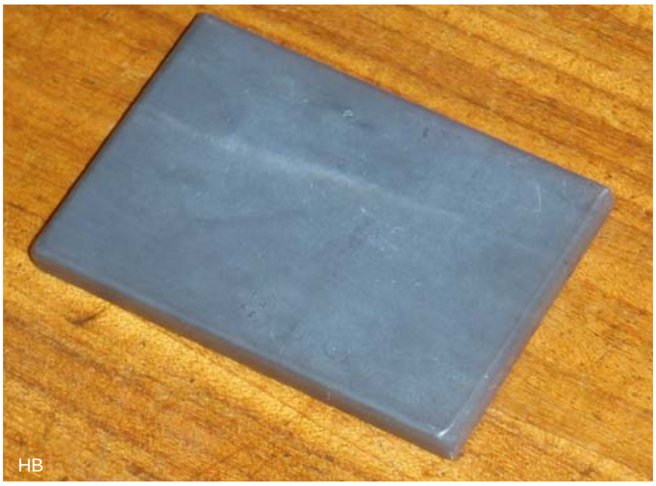


When mowing, the stone or ceramic strickle is worn in a holder on the belt. The holder contained water to keep the stone moist. There are many variations on this subject of wood, cow horn and brass.



Hottefile - IJstijdenmuseum

Toetssteen - Proofing stone



Consists usually of Lydite: quartz with impurities.
The rectangular black, shiny pieces that we often find in the gravel from the Netherlands, originally was a kind silicon slate deposited on a seabed of small organisms such radiolarians. Only the black stones are usually called lydite, other colours get the collective name of silicon slate.

Lydite stones, as they can be found in the Meuse and Rhine gravel, come from the Ardennes and from central Germany (Rhenish Slate Mountains, Fichtel Mountains). A pure version of lydite was once (and still is) used as a proofing stone to test the gold content of jewellery and coins.

Water stone



Water stones produce the best cut in the shortest possible time. For polishing of a cut no oilstone, ceramic or of natural origin cannot compete with a water stone.

Whetstone
Special type of flat stone used to sharpen tools or weapons or to get rid of burrs; also strickle, oilstone, water stone.
Is a chisel well sharpened, we feel a burr on the cutting edge.
These burrs must be removed, which only can be done by a whetstone or oil stone. These whetstones are traded in different types and forms. A good stone is considered the stone that makes no scratch when the edge of a penny or halfpenny is taken over it by great pressure. From:
Fix yourself do it right! Bernard Weickmann May 1944.



Wrijfsteen - Rubbing stone



1) Chinese ink is rubbed on a circular or rectangular rubbing stone.
2) In preparing paint: the dyes mixed with water (tempered) must first be rubbed with the stone, otherwise there is the risk of streaky work.
The painter used (among others) the colours provided by Mother Earth. These had to be mixed with linseed oil.
To achieve a fine enough mixture the painter for over two thousand years used a marble slab and a rubbing stone.
In the jargon a rubbing stone - often a stone grinded in shape - was called "runner". Besides the rubbing stone later was used a glass runner. This was specially designed for processing white pigments, because the stones could contaminate it.
3) Rubbing stones were used to grind tools such as needles of wood or bone, probably also for grinding and smoothing stone objects.

Zadelsteen - Saddle stone also quern stone



The next step in the evolution of the rubbing stone was a large, asymmetrical, elongated shape of the lower stone (the beam) which was almost perfectly flat. This resulted in a more efficient use of the back-and-forth movement.
This form can also be seen as the direct precursor of the better-known saddle stone that emerged from the Neolithic. The latter looks quite similar, but has a concave surface.

This type of grinding stone was used throughout the Neolithic. In this form grinding stone knew some variation and evolution. It became several times bigger, in some places or at certain times the concave surface was more pronounced, the finish got more attention and they were better suited to domesticated crops. From: Sharpening stones through the ages: an archaeological perspective on industrial production, evolution and use of grinding stones. Master thesis by Tacco Truyen Van Geer 2009-2010.

Zoete steen - Finishing stone



Fine and soft whetstone, also fine sandstone. A finishing stone provides a still finished surface, neither too soft nor too hard. Pretty uniform in composition, the grinding stone does not gnaw the tool. You can compare it to grinding with an artificial grinding stone with a fine grain. Nowadays you can order stones in each grain size, formerly it was just luck, therefore a finishing stone was cherished by the expert because his tools profited when it was used.

In his best-seller "The Seven Habits of Highly Effective People" author Stephen Covey introduces a seventh property: "Keep the blade sharp". The name of the seventh property is based on the following anecdote:

Somewhere in the woods of Japan for days a sawyer is feverishly at work.
One day an old Zen master comes along and starts a conversation with him.
"How long have you been doing your job?" asks the old master.
"For more than seven days", says the tired looking sawyer while he wiped the sweat from his brow.
"And it seems increasingly difficult to continue".
"But why not just stop and make the cut sharp again? I am sure it works a lot faster".
"I don't have time to sharpen the cut", the man says resolutely. "Because I still have to cut down so many trees".

Historical finds



Assets / # 76708: Ancient Native American Sharpening Stone. A large grinding stone used by many generations of Indians in the shade of a tree on the edge of a lake, available at (48.652 ° N 118.735 ° W).

Introduction
Grinding and polishing stones for flint axes are an important category of artefacts in the Netherlands little has been written about and therefore are not well known.
Also in foreign literature they are rarely mentioned.
Nevertheless, it must have been important tools.
In Friesland and Groningen a large number of artefacts are found mainly in the first half of the last century and special in the thirties, when the great marsh and heath lands were opened up. The workers were encouraged to collect and to report findings. Also the stone traps of the potato plants have yielded numerous artefacts

Making a flint axe
The Neolithic period was formerly known as the period of the polished axes. This period has yielded many beautiful polished flint axes that appeal strongly to the imagination. The finest specimens are so well made that no trace of tooling is visible. Despite the many studies the way of polishing is rarely investigated. Only in 1983 study's (Madsen and Olauson) were published which also describe the process of manufacture. In the production process four stages can be identified namely:
1. Obtaining the raw material,
2. Tooling the right form,
3. Grinding and
4. polishing.

Obtaining the raw material is highly dependent on where the maker resides. A good quality of flint is needed.
In Denmark, with its cliffs with its common flint banks, there will have been no problem while in the Netherlands they had to use imported flint or flint from a moraine.
Imports consisted not of flint nodules but of processed axes.
For us, the third and fourth stages are interesting. In the third stage the axe was grinded into shape.
Stationary large coarse-grained sandstones were used that still can be identified by the grinding tracks.

A well-known whetstone is the one in Slenaken, now a national monument. This boulder also shows that the grinding of the various sides of the axe caused corresponding grooves: a wide groove for grinding the side and a narrow V-shaped groove for the side and the cut.

A well known whetstone is the one in Slenaken now a national monument. This boulder also shows that the grinding of the various sides of the axe, caused corresponding grooves: a wide track for grinding the side and a narrow V-shaped groove for the cut on the side.



The Whetstone of Slenaken is a boulder lying along the banks of the Dutch river Gulp just south of Slenaken.
In the Neolithic the stone was used for grinding flint axes.

Although now it is situated a few meters above the present bed of the Gulp, the stone lay probably in or near the river in the Neolithic, since for grinding flint not only a grinding stone, but also water is necessary.
Since then, the Gulp deeply incised into the landscape, so the stone is now meters away from the river. The stone was discovered in 1953 by an observant amateur archaeologist.

It is in the National Cultural Heritage registered as national monument 46147, and is of high cultural value.
Source: Wikipedia.

An assumption is that for polishing smaller portable polishing stones of very fine-grained sandstone were used. These stones resemble a hollowed piece of soap and weigh about 5 to 10 kg. Their grinding surfaces are usually very smooth and glossy. This soap shaped stones are found in the Netherlands, England and Scandinavia.



© National Heritage Board, Department of Marine Archaeology Lelystad.

There are also bone shaped grinding stones, with usually more than 4 abrasive surfaces, about 20 to 40 cm long and 10 cm thick. The bone-shaped centre section is created due to excessive wear.

Through practical research is found that it is possible to make an axe in 5 to 7 hours. By trying out has been found that the axes stayed sharp quite long and 34 trees ranging from 4 cm to 40 cm thick could be cut in succession.

Historical Items
Historical whet and grinding stones are quite rare in Dutch museums. Of course there are objects in the Netherlands but there is little incentive, let alone knowledge.
We went to look at the artefacts in the archaeological depot in Lelystad which is part of the National Cultural Heritage. The contact was made during a lecture at the Maritime Museum in Amsterdam. The result is overwhelming.
A list was made of the objects with 'whetstone' or 'grinding' in the object name. We arrived at 103 objects that we all checked with the expert help of Mrs. Mr L. (Laura) Koehler, Marine materials specialist.
We got plenty of time to a see things and take photographs. An experience.
A few highlights we would like to show here. First two objects from the wreck SO1 (Scheurrak Omdraai) were we found Norwegian Eidsborg whetstones. The excavation started in 1989 and completed in 1997. See also the intermezzo.
Then a special stone that came from ship wreck BZN2 (North Burgzand 2), also known as the Polish guns wreck.

Eidsborg whetstones also used by Vikings



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SO1-15054. Eidsborg a whetstone from a merchant ship (flute), which sank in the western Wadden sea (Scheurrak Ommedraai) north of Den Oever, on the east side of the Texel. The stone is from before 1593 because then the ship sank. © National Heritage Board, Department of Marine Archaeology Lelystad.

Whetstones were essential tools in times gone by.
They were an important part of someone's personal tools and indispensable for anyone using knives, chisels, arrows, sickles, scythes, needles, scissors and any other iron tools or weapons. A good example is the time Vikings travelled half of Europe, they were particularly dependent on their iron tools to survive. They preferred to use stones from Norway.Norwegian whetstones are made of fine-grained shale and were obtained from a quarry at Eidsborg in Telemark County in southern Norway.

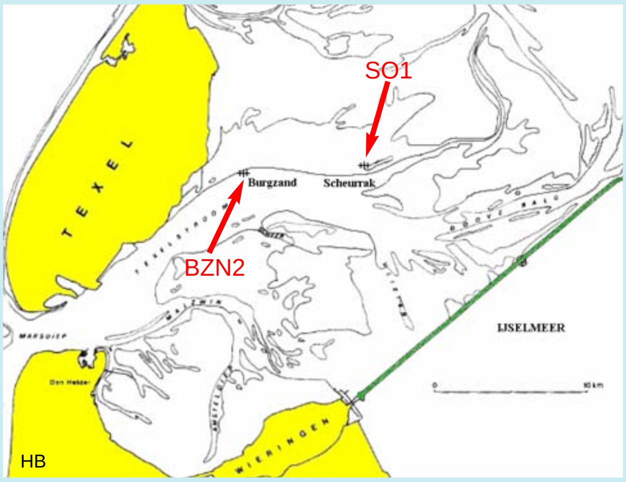


HB

SO1-23013.9 Eidsborg pocket whetstone from a merchant ship (flute) sank in the Scheurrak Ommedraai in the western Waddenzee north of Den Oever, on the east side of the Texel. © National Heritage Board, Department of Marine Archaeology Lelystad.

SO1 An early 17th century merchant ship in the Scheurrak

On August 2, 1981, in the Scheurrak Ommedraai (SO1) the wreck of a flute was discovered by Mr. C.J. Eelman from the Koog on Texel. Shortly thereafter the discovery was reported by telephone. The wreck lies directly north of Den Oever, where Scheurrak branches off of Texelstroom. Close by is the red buoy T24 so the wreck got the working title T24.
It's a simple merchant ship from the end of the 16th Century. The ship transported wheat harvested along the Vistula in Poland. This place was called the granary of Europe. The ship was built around 1580 with a length of about 35 meters and possibly perished on Christmas Eve 1593 on the Texel anchorage.



Norwegian whetstones are made of fine-grained shale and were obtained from a quarry at Eidsborg in Telemark County in southern Norway.
Already in Viking time, the 9th century, these stones were exported throughout Europe.
Usually the stones were loaded in the port town Skien. They were often carried as ballast in their ships, and later traded and finished into usable whetstones.
The whetstones were needed to sharpen their excellent weapons like the old sagas tell us. Later the stones were used for more peaceful applications.

The Eidsborg quarry has provided good whetstones for the timber industry and many traditional home-working professionals. Strontium isotope analysis indicated that the stones found during excavations in England, Denmark and Poland came from Eidsborg quarries. The quarries have continuously produced and the last is only closed in 1970.

The Vikings had no pockets, but by a hole in the stones they could be carried on the belt or harness. Some are so beautiful that they were also worn as jewellery.
There is a museum in Eidsborg with pictures of something that looks like stacked wood but actually is stacked stone from the quarry.

Eidsborg whetstones are extensively discussed in Chapter 6 Eidsborg Norway (NO).

Coticule over 360 years old
The following object is a coticule (BZN2-838) and is found from ship wreck BZN2 (North Burgzand 2), sometimes called the Polish gunboat wreck.
It went down about 1650 AD. and is still 'in situ' in the Wadden Sea. A diver from Texel discovered the wreck in the summer of 1985 at the Burgzand at a depth of 10 meters.







© National Heritage Board, Department of Marine Archaeology Lelystad.

This is a combination stone, that is a stone composed of 2 parts, glued together. This was probably done with gelatine.
We call such a stone a combo.
The disadvantage is that the glue is water-soluble in the long run, so two loose stones are created again. Many old razor stones show this problem.



Above razor stones are from 1930 and also have this bond.

Cleaning dirty stones



When buying a stone it is often a struggle to determine what kind of stone you have in your hands.
Every stone I buy, I want to handle to be able to see what I buy.
Via Ebay or E-market often you cannot see what it is and the prices are through the auction mechanism much too high. That's why I go to the dealer to see what he has in store. See the chapter: Identifying.
After buying the question remains: what did I buy and is my presuming correct.
This I only can see when the stone is clean and I mean really clean.



There are various methods devised to clean a stone.
The method I use is as follows.
We clean the stones by placing them in an old pan with water and a dishwasher tablet. Make sure the temperature rises slowly to avoid splitting.Keep the temperature for about 3 hours at 80 to 90 degrees Celsius.



Brush the stone in the soup to loosen the dirt on the surface, remove the stone with a quick movement from the soup, place in clean water of the same temperature and rinse the stone again.



This stone was not possible to identify. The solution of this riddle is shown on the next page.

Oil-filled stones



As you can see I clean these in open air on a special 'work' table. Oil-filled stones are well to use but in practice difficult in a collection. Every time you handle them, your hands get dirty and you have a greasy stain when putting down. Therefore: do clean these stones so no oil comes out any more. Before removing and rinsing the stones from the washing water remove the layer of oil.
This goes well a sheet of kitchen paper laid on the solution to absorb the oil. Repeat with clean sheets of paper as much as needed until the paper remains clean. For drying you can put the stone in a sawdust container. The sawdust can then absorb any remaining oil.



After cleaning it was a very fine engineers stone of SiC (silicon carbide).

Salt
For oil-filled stones sometimes it is recommended to put the stone in salt for a few days. The salt should then absorb the oil. I never tried this method.

Dishwasher
It is sometimes recommended to put the dirty stone in the dishwasher. This sounds no a good idea to keep peace in the home. To keep peace at home I clean in a special place although I have the luck that my wife understands. This has resulted, among others, in the fact that I may use the roasting pan for this application.

Other cleaning agents
* Instead of a dishwasher tablet also is known that baking soda (biboras natricum - sodium bicarbonate) is used.
* Another way is using TSP (trisodium phosphate).
* Oven cleaning agent is also used.

Surprises







This proved to be a Hindustan!





This proved to be a Turkish stone! The Vera de Candia.

Determination

Determination method for a stone

Factory made whet and polishing stones for optimal finish are characterised by the following:

* Type of abrasive material;
* Grain size;
* Variation in grain size;
* Structure;
* Hardness;
* Bond;
* Variation in the bond;
* Porosity and
* Impregnation.

For the determination of natural whetstones we can use the same variables.

Scientists use special methods to study construction and composition of minerals:

* A micro-probe to determine the composition;
* X-rays free of powder or crystals;
* Optical investigation;
* Spectra at different wavelengths;
* Behaviour on heating, etc.

Besides al this for minerals there are also some simple tools, which also can be used by amateurs:

* Determining the Mohs hardness by comparison with a standard set of minerals;
* The scratch, caused by a mineral on unglazed porcelain;
* The possible crystal form and cleavage;
* Colour and lustre;
* Similar mass (density);
* The paragenese, that means which minerals occur together;
* Some simple chemical tests that quickly can show which elements can or can not be contained in an unknown mineral.

Determination of whetstones
Determination sharpening stones is a bit complicated. Being a non-professional you can do almost no measurements. Reading and studying the photographs a lot should help to gain the knowledge. Descriptions of stones are scarce and can be found fragmentary on forums. Experience can be replaced by nothing, but it must be gained by looking at stones in collections, museums, shops, talking to experienced collectors, reading books, taking in illustrations and fieldwork.
For many years I collect pictures and information of and about sharpening stones, grouping them on country and variety.
It shows to provide a wealth of information.
As a beginner, you do not have all this and it's a big job to get it al right.

The information is not easy to find, searching takes a lot of time or the information cannot be found. This work is an attempt to contribute and tries to form a guide to identify a whetstone.

Finally, one can also join forums such as SRP, where there often are more experienced members who can help.
If neither of these options helps, one can as a last appeal turn to professionals.

There is a huge range of second hand whetstones.
For the seller and the buyer it is important to identify the species to avoid misunderstandings. Whetstones can be identified by their properties (= Characteristics) and you identify them with the determination table.
Determination is easy for some stones while with others it can be very difficult. We have the following options:

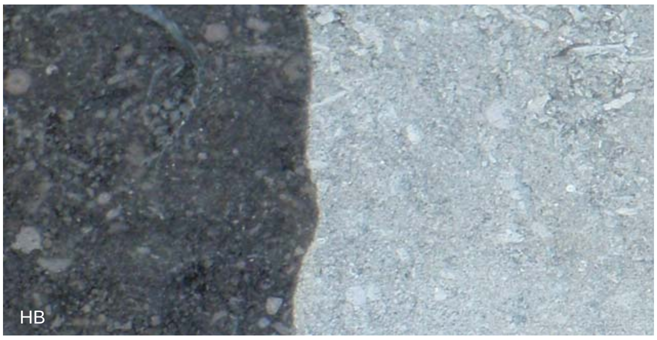
* Appearance;
* Structure;
* Coarse or fine is determined by the grain size;
* Sound;
* Stratification;
* Colours and colour patterns;
* Change in colour of the water or oil generated during grinding (slurry);
* Inclusions;
* Density (specific gravity);
* Hardness of the bond between the abrasive grains.

The appearance.
Immediately at the start this is very difficult as all heavily used whetstones are black because of the oil with iron



particles.
For some, it is possible to use a cheap knife to remove slices of the dirt. Therefore: the stone has to be cleaned first so all the grease and dirt is removed. For some, this is a drawback as it removes the patina of the stone. When you buy a stone to use the choice is not difficult while it is also easy for museum purposes: do not clean. Unfortunately, the stone than cannot be identified.

Structure
The structure of a stone shows how the components are arranged. Do they form a mosaic or are they arranged in stripes, bands or layers?
This indicates immediately the direction in which to look: an igneous rock, a metamorphic or sedimentary rock.
The structure is most clearly visible when the stone is flattened. The smoother the surface, the clearer structure and colour.



By dampening the structure also becomes visible.
The contrast becomes better when wet, so the colour and structure can be observed better. This is based on the changes that occur at the presence of water in the refraction, absorption and reflection of light.
Using a polarizing filter while taking pictures can give a huge improvement because there is often a reflection.
Fracture surfaces and cracked off angles often give a good insight into the structure of the stone.



Rupture Plane of the blue-green Roszutec sandstone of Veľký Rozsutec in Slovakia.

When broken the minerals look different than from the outside.
This extra information can be useful. Often this is an opportunity to identify a dirty stone.

Coarse or Fine



2 quartz sandstone Due Medaglie Pradalunga from Italy. Left the fine F500-600 (13 µ) and right F 280-320 (35 µ).

The first thing to look for is the grain. If there is a noticeable or visible grain, than it is sandstone.
Is the grain not visible then it is a slate or a novaculite.
The application of the whetstone is determined by the fineness of the grain. For an axe the grain can be between 220 and 800, while for a razor the required fineness can reach 8000 to 30,000.

Sound

It is surprising to hear how much difference there is in the sound of a tapped stone. Take the stone in the width between the forefinger and thumb, at about one third of the length and knock on the stone with the back of a small screwdriver. The sound may vary from bright to very dull. If the sound is dull then usually there is a tear. Check carefully whether it is safe and if the stone will not break.

Stratification



The Hindustan whetstone from America is very clear to identify by stratification. Stratification and its appearance can be a specific distinction.

When there is a layering to be found in the stone than this indicates a sedimentary origin. Layering or sedimentary layering (bed) is in geology a planar structure in rock, formed by sedimentation of layers of sediment one over another. Save in sedimentary rocks layering can occur in volcanic rock, where it is formed a similar way. Sometimes in a metamorphic rock sedimentary layers can also be distinguished.

The stronger a metamorphic rock is recrystallized, the less of the sedimentary layers can be recognized.



In this waxy translucent Arkansas (3 -5 µ) is no stratification or grit to recognize.

In highly metamorphic rocks, a sedimentary stratification can be preserved as a difference in litho logy (difference in composition), while in other sedimentary structures completely they are disappeared, as, for example, in Arkansas Novaculite.

Colours and colour patterns

The colour of a sedimentary rock usually is caused by the presence of iron. Iron can occur in the form of two oxides: iron (II) oxide and iron (III) oxide.

Iron (II) oxide forms only under anoxic conditions and the rock turns grey or green. Iron (III) oxide, often in the form of the mineral hematite; colour the rock red or brown.
In a dry climate, due to the oxidizing effect of the atmosphere, rocks can expose a reddish colour.
However, a red colour does not necessarily mean that a rock is formed in a dry continental climate. Thick layers of rock packages with a red colour are called red beds.
The colours and colour patterns are discussed in the description of the whetstones (Part 3).

Slurry colours with a rubbing stone
Many whetstones are used with a slurry. Slurry is created when a wetted whetstone is rubbed with a similar stone. In coticule it creates a kind of "milk" in which the separated garnet particles are used during the honing. See Part 1 "grinding and honing".

All slurry stone grinding is faster. The disadvantage is the surface becomes mat. For a high gloss wash off the slurry with water, after that a high gloss is created.



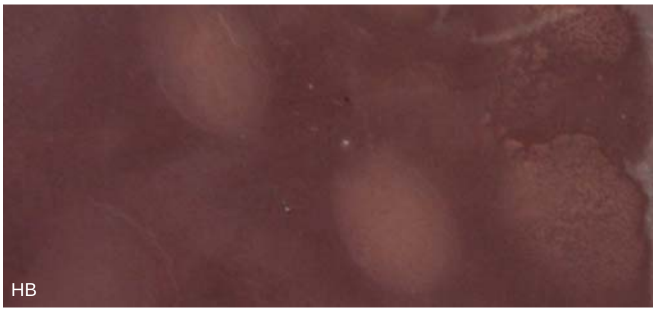
Coticule slurry is milky white to light brown. The dark slurries grind faster.



BBW slurry is dark purple.



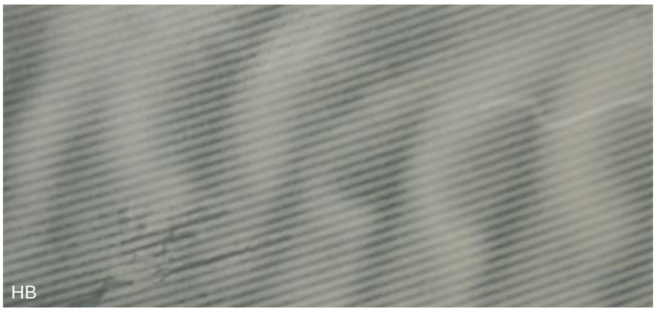
Charnley Forest slurry is greyish white to rose for a stone with many red spots.



Dragon's Tongue slurry is dark grey to purple depending on the stone colour.



Escher Thuringer water stone slurry is light grey to grey-white.



Frankonian stone has a slurry with the colour of "cafe au lait".

It often happens that a grinding stone has no slurry stone. Then you can use very well a Japanese Nagura.
Remember that slurry generated during the grinding of a blade gets dark from the reduced metal particles.

Inclusions



Pyrite inclusions are sometimes found in Thuringer whetstones are no danger to the object to be sharpened. Pyrite is soft and will not damage the cut even though they sometimes break out and take with it grains that may do damage.

Pyrite is also called "fools gold".
Sometimes there are dark inclusions that sometimes are soft and sometimes hard. It also happens that a stone is not hard evenly and therefore cause irregular wear.



Unsolicited inclusion in a Rozsutec.

If you buy a second hand stone is wise to agree with the seller that if the stone has hard inclusions it can be returned.

Density (specific gravity)
The density or specific gravity of a stone is a quantity that expresses how much the rock mass contains at a certain volume. Often the older (but incorrect) term specific gravity is used. Traditionally density is indicated with the Greek letter P or rho.
The formula is: P = m / V where m is the mass expressed in kilograms or grams and is V the volume in dm ³ or cc ³.

Example:
A stone weighs 150 grams, length = 142.5 mm,
width = 38.5 mm and the thickness is 10.5 mm.
The content is 14.2 x 3.85 x 1.05 = 57.40 cc.
Mass = 150 / 57.4 = 2.61.
This is very dense and it will be a stone that does not absorb moisture.
In this case it is a translucent Arkansas.

In the Système International density is expressed in kilograms per cubic meter (kg / m ³). The older unit (in the cgs system) grams per cubic centimeter (g / cm ³) or kilogram per cubic meter is also used.
The conversion is: 1000 kg / m ³ = 1 g / cm³ = 1 kg / dm ³.

Some examples:
Of Soft Arkansas is the density P 2.20 to 2.30; for Hard Arkansas 2.30 to 2.45; True Hard Arkansas Colour Translucent; Arkansas Black, Translucent and White Lily 2.50 and higher.

The density of the stone is a measure for the maximum water absorption. At higher densities the grains are very close together and there is little space between.

Hardness or scratch ability
A mineralogist measures the hardness of a mineral through a Sclerometer (skleros = Greek means "hard") that is an instrument a mineralogist uses to measure the hardness of materials in the Mohs' scale.
With the unit an increasing pressure is performed with a diamond point on the surface under test. The pressure, at which a scratch occurs, is proportional to the hardness.
As with artificial whetstones the hardness of a stone consists of two components namely:

* Hardness of the abrasive grains. These determine until which hardness a knife or chisel can be sharpened.
* Hardness of the bond. There are hard and soft stones. With soft stones the grinding grain quickly is replaced what gives the feeling that the stone is 'grippy'. These stones wear out faster and need to be flattened more often.

Arkansas is an exception. Arkansas consists of pure silicon compressed so much under high pressure and temperature that there is no longer a connection between the spaces between the grains while the grains are 'sintered' together: there is no binding required nor available.

In coticule mainly it is the softness of the bond that varies. There are soft to very hard coticule stones. This 'hardness' can be tested by a scratch test with hardness needles (see below). The hardness of the manganese - aluminium garnet crystals (Spessartine = Mohs 7 to 8) is harder than most steels.

Testing hardness
The scratch test needles make it fairly easy to judge the binding of a stone to be determined.

* With your fingernail you can scratch hardness of minerals to 2.5.
* With a copper coin or a piece of brass you can scratch hardness of minerals to 3.5. According to my grandfather a good coticule cannot be scratched with a copper coin.
* With glass or a nail you can scratch into minerals the hardness of minerals to 5.5.
* From hardness 5.5, the stone scratches on glass.

The above tools are possible, but very roughly. For the higher hardness, harder needless are recommended available from MTN Giethoorn, see:
http://shop.mtn.nl/catalogus/productdetail.aspx?ProductId=764.



MTN Giethoorn also provides a hardness testing box with selected minerals and a dash plate see:
http://shop.mtn.nl/catalogus/productdetail.aspx?ProductID=765.
This is also for testing the designation of a sclerometer.

Caution! Each stone is unique. The stones from the same quarry can vary a great deal both in grain hardness, grain size and the bond keeping the grains together.
It is often a matter of trying to find the right stone for a particular knife. Many people once have tried to decide on the hardness of a stone with the help of a scriber.

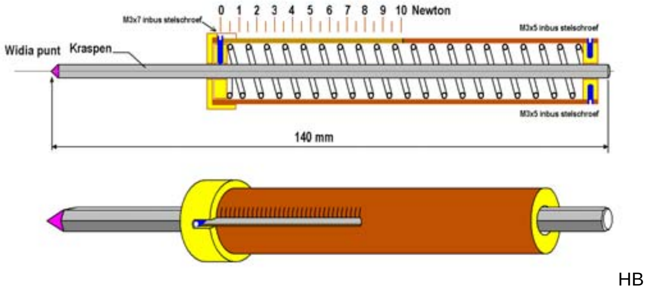


Hardnesspen Labomat of SP0010. A pocket instrument for testing the hardness and wear -/ scratch resistance of the materials. Tungsten Carbide a point is drawn over the surface with a predetermined constant pressure.
See: www.labomat.eu
The instrument comes with 3 springs:
- *0 - 300 g 10 g scale part*
- *0 - 1000 g scale portion 50 g*
- *0 - 3000 g 150 g slab*

The hardness of a whetstone is determined by the strength of the bond between the individual grains. For grinding grains smaller than 150 it is expressed as a number from 0 to 200 where 200 is extremely soft and 0 extremely hard. Hardness of industrial sharpening stones is tested with a ball with a diameter of 5 mm pressed with a force of 10 kg into the stone.
This seems not nice for our precious whetstones. I already see a stone of 100 Euros explode. We need something different.

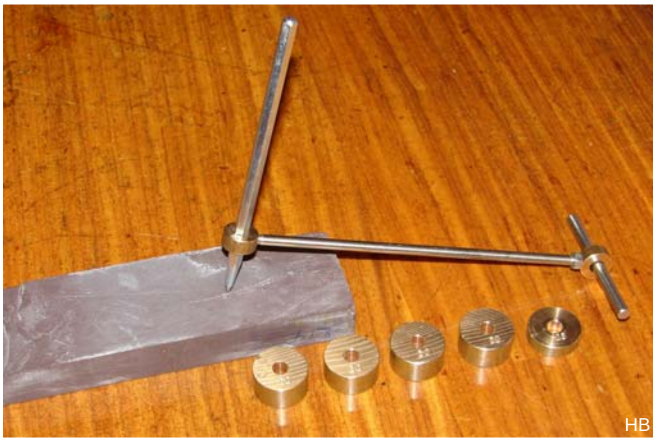
Turner's Sclerometer
An indication of the grain bonding can be obtained with a Turner's Sclerometer. In this test a diamond point is drawn on the object, once forward and once backward.
The hardness is the weight in grams required to produce a standard scratch. A scratch that is just visible to the naked eye as a dark line on the surface.

A Sclerometer of Elco (Elcometer type 3092 Hardness Tester) cost $ 560.00.
For that money you may buy quite a few whetstones and than buying stones has my preference.



After some pondering, a sketch was made for a homemade sclerometer. Made with a carbide scriber some scratches with the test set of MTN while the stone was on an electronic scale.
Some values were put down to get an idea about the required resilience. Slate needed a force of about 100 grams and Arkansas around 2200 grams.

After thinking a while there have been made two designs .



Model 1 is a test probe with interchangeable weights.
To do a test without weights the pressure to the needle tip is 50 grams. Can test from 50 grams increasing with 25 grams up to 250 grams.



Model 2 has a spring (spring 2040) and weighs 87 grams. Can measure from 200 grams to 1200 grams with a scale of 100 grams. The intermediate values are determined by interpolating. Under 200 grams it is not possible to use. Therefore, afterwards model 1 was made.

Model 3 is similar to model 2, with another spring (5240) and a probe test pressure of 500 grams to 3000 grams. Because of the spring it is possible to calculate the values in between by interpolation.

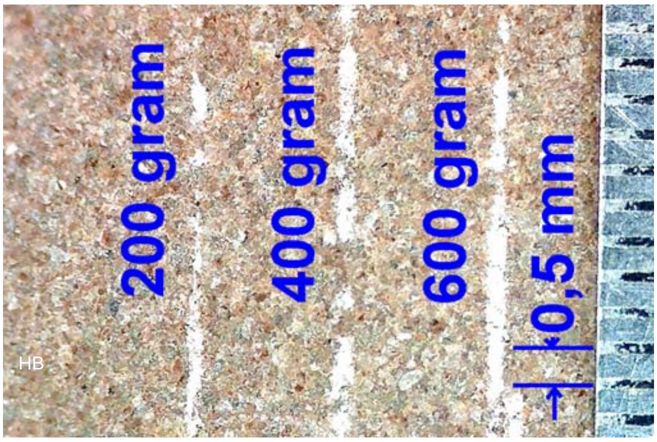
It consists of an 88 mm copper water pipe with an outer size of 15 mm.

Using the computer program of the company Alcomex in Opmeer some springs were calculated.
http://www.alcomexveren.nl/Drukveer.aspx?reset=true

number	bush	as	const	L long	L short	delta L
1830	11.6	8.6	0.33	66	18.1	48
1840	11.6	8.6	0.23	96.5	28.5	68
2040	11.8	8.4	0.55	81.5	32	49.5
5240	10.5	7.7	0.18	88.5	21.2	67.3
5480	13.3	9.9	0.35	73.5	28	45.5

After an email exchange with an explanation we went to Opmeer to fetch 5 springs. When we wanted to pay a handshake was sufficient. What a service! We could make now 2 Sclerometers with a spring constant of 18 and 55 Newtons and a pressing force of 1.2 and 2.7 kg respectively.

This allows us to proceed up to Mohs 8. We now want to determine the hardness of the bond of a lot of stones in the database so we can use this value in determining.
The price per piece is about 7 euros. Caution! It remains an indication. By measuring with the same method with the same carbide scriber point there is a comparison possible of the stones.



These scratches are made on a Rozsutec. The pressure is increased until after wiping a scratch with a width of 0.3 mm is created.

Hardness of steel blades
The hardness of metals can be expressed in Brinel and Rockwell (HRC). Almost all blades are made of steel. However, the steels are different.

Hardness is not the only characteristic of steel
Other mechanical properties include the tensile strength, toughness (impact resistance), cold brittleness. In addition, corrosion resistance is an important chemical property. The hardness alone is not everything.

The following table provides an overview of the potential hardness of steel knives that can be sharpened with natural whetstones.

* 43 to 52 HRC is called tempered steel and is too soft for making knives. Above 52 HRC it is called hardened steel.

* 52-54 HRC: Quite mild steel, reasonable quality.

* 54-56 HRC: The hardness of many French chefs knives. The steel is hard enough for use in the kitchen, but regular use of a knife sharpener is needed to keep the blade sharp. Knives with this hardness are usually easy to sharpen.

* 56-58 HRC: Hardness involved in professional German kitchen knives. Knives with this hardness stay sharp long enough for use in the kitchen, its just can be sharped by a knife sharpener and are fairly easy to sharpen.

Artificial whetstones needed for sharpening
* 58-60 HRC: Hardness you usually see in the best pocket knives such as Spyderco, Cold Steel and Buck, and kitchen knives from Japan, such as Global. These knives stay sharp much longer than cheaper knives, but are a lot harder to sharpen.

* 60-62 HRC: knives with this hardness stay sharp a long time, but there risk of embrittlement and the blades are often difficult to grind. With modern steels these disadvantages are reasonable to suppress, but the quality is highly dependent on the quality of the entire production process.

* 63-66 HRC: There are knives available with hardness up to 66 HRC (Twin Cermax by Zwilling JA Henckels). These knives are not for the majority of users, but more for a specific group of fans. Knives with such hardness have disadvantages such as brittleness that causes the outbreak of pieces of the blade when used careless, and often a low resistance to corrosion. Therefore, clean the blades immediately after use and preserve an oil cloth.

The Mohs hardness of a pocket knife is 5.1
The Mohs hardness of a razor is about 5.3



Lapping



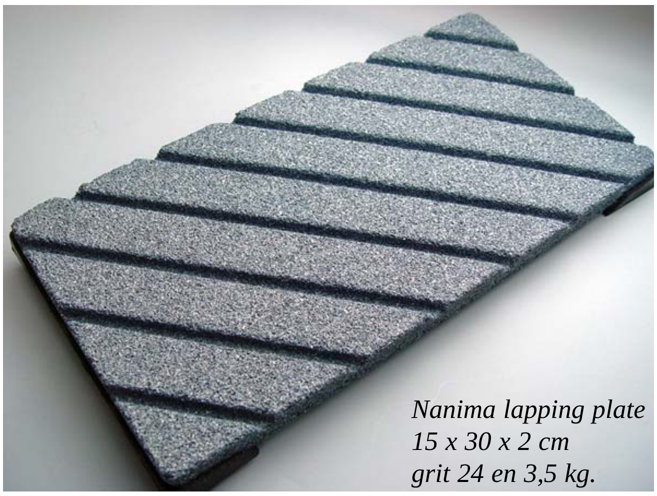
On this stone many razors are sharpened and it is nearing the end of its life. Razors still can be sharpened in this way but not a chisel or planer. You need a flat stone so the cut will be plane.

Almost all 2nd hand stones are more or less hollow and so it is necessary to flatten the whetstone after cleaning. see: http://straightrazorplace.com/srpwiki/index.php/Hone_Lapping_101

Silicon carbide lapping stones



Norton



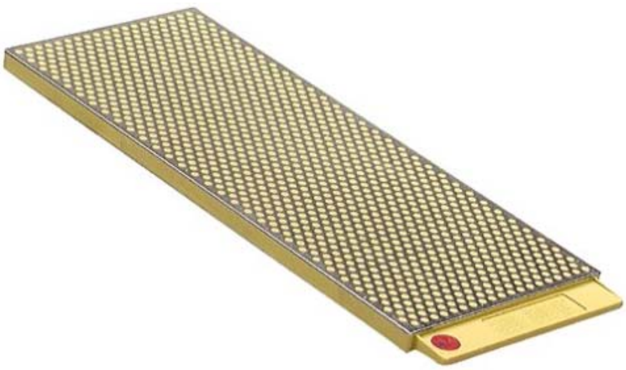
Nanima lapping plate
15 x 30 x 2 cm
grit 24 en 3,5 kg.

Silicon carbide stones are specially made to make stones whose surface has become filled with metal particles, in order again.

Diamond lapping stone



The Shapton DGLP (Diamond on Glass Lapping Plate) is designed to plane 'Shapton Ceramic Water Stones' to a range of 500 to 30,000.



DMT duosharp Blue 325 mesh (45 microns). - Red 600 mesh (25 microns). DMT uses monocrystalline crystals embedded in a layer of nickel.

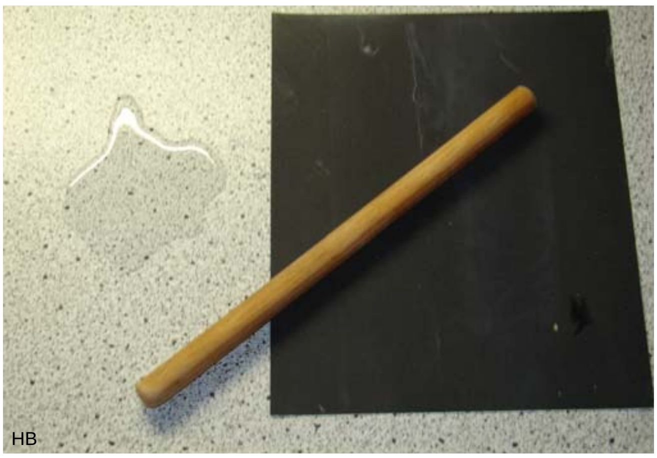
Attention!
Preferably use Diamond Stone for the first time on a cheap whetstone because there still are crystals that protrude slightly. These disappear in use and the surface of the diamond layer will become uniform in height.
It's a bit a sin to make deep grooves into an expensive whetstone.

Diamond stones having a length of 8 or 10 inches are ideal to flatten the honing stone's surface and are widely used for this purpose since they also are able to manage hard stone properly. First use the 325 and then the 600 side.
Diamond stones make short work of surface contamination and are lubricated during use with plenty of water.
More info on:
http://www.onlinetoolreviews.com/reviews/dmtw250fcnb.htm

Cheap way to flatten whetstones
What we use to flatten a whetstone: a sheet of waterproof sandpaper grit 320 and a sheet with grit 600, a glass of water, an HB pencil and a flat surface for example the sink (in our case a plastic kitchen slab HPL) or a perfectly flat table top with plastic surface.
It is important to use quality sandpaper and before using it knock it out so no loose abrasive grains will be pressed into the areas of the hone that have to be flattened.



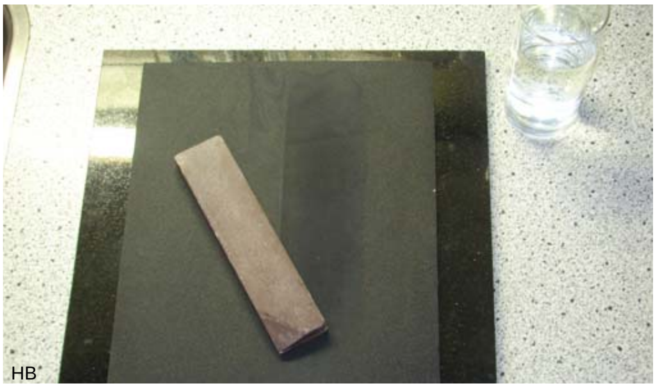
This coticule does not absorb water and does not be pre-immersed in water to absorb water.



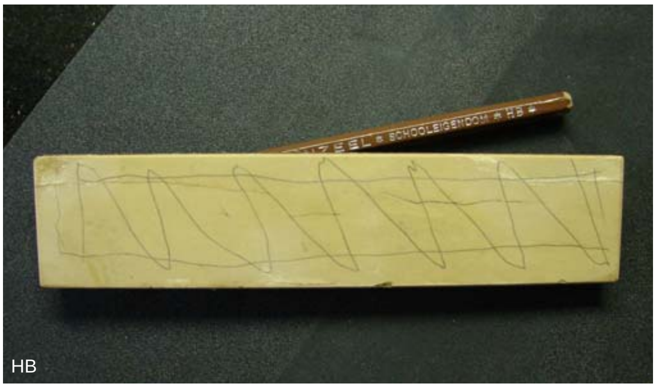
Pour some water on the work surface and put the sandpaper on it. By using a round stick or rolling pin going over it, we create a vacuum under the sandpaper so the paper will keep in place during sanding.



My wife does not like it when I flatten whetstones on her working surface. With large stones there is a high risk you may slip and make scratches.



Therefore, in the DIY we bought a 31 x 31 x 1 cm granite tile to serve as a substrate.
With a damp cloth under the tile it remains in place and does not shift.



With pencil is a grid drawn on the stone.
This allows us to verify the surface of the stone indeed has become flat.



The drawing shows that the stone is a still a little hollow, therefore repeat the operation.



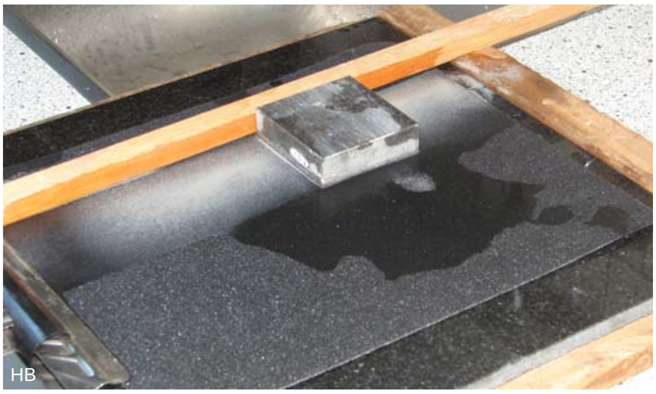
All pencil marks are gone.
The stone is all flat but a small spot and after just one more time lapping with grit 600 and the stone feels very smooth. The yellow coticule side is ready to be used again.



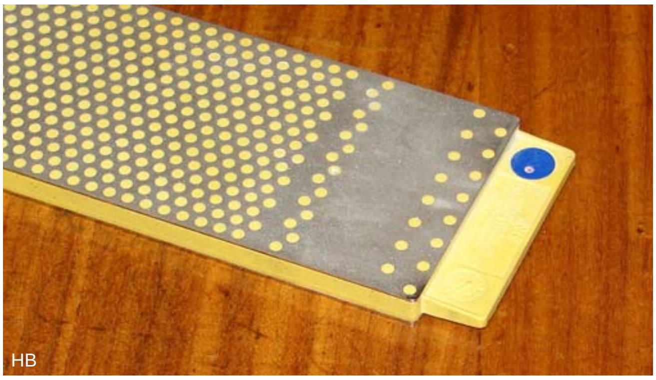
Make sure all sharp edges of the stone are removed, so no damage can occur to the object to be honed. Eventually make some round edges freehand with waterproof paper to complete.



The back of this old Rouge du Salm (BBB) stone is very useful for grinding. Therefore, this is also flattened.



As an alternative to the wet cloth here a wooden saw board is used to put the tile onto.
The sample was used in the story of machine lapping of surfaces.



As an alternative to the waterproof sanding paper, a DMT diamond stone can be used. It is simple to use and gives a lot less mess but the costs are considerably higher.



The DMT can be kept loose by hand. In this way it is easy to make a circular motion, and the result is perfect.



Here is the stone placed in the sink. This works uncomfortable because the stone begins to slide.



A more convenient way is to make use of a so-called grinding bridge.
http://www.amazon.de/Schleifbr%C3%BCcke-Schleifbank-Schleifhilfe-Schleifvorrichtung-komfortablen/dp/B001TPACNU

Lapping machine

Second hand whetstones often have a life of intensive use behind them. They usually aren't quite flat and it can be hard to recognize the stone structure. They need to be lapped at the appropriate grit level. This is done mostly with waterproof sanding paper used with water on a flat glass or stone surface. A pencil grid is drawn across the surface of the whetstone, and when all the pencil marks are sanded out, the hone is flat.
Easy as pie - as long as you're dealing with soft stones. With hard varieties, it's a hopeless chore. Especially Rozsutec, Charnley Forest and Arkansas are very hard hones. Lapping them takes considerable time, not to mention muscle ache. Perseverance in this case may result in lasting damage to both health and hones…



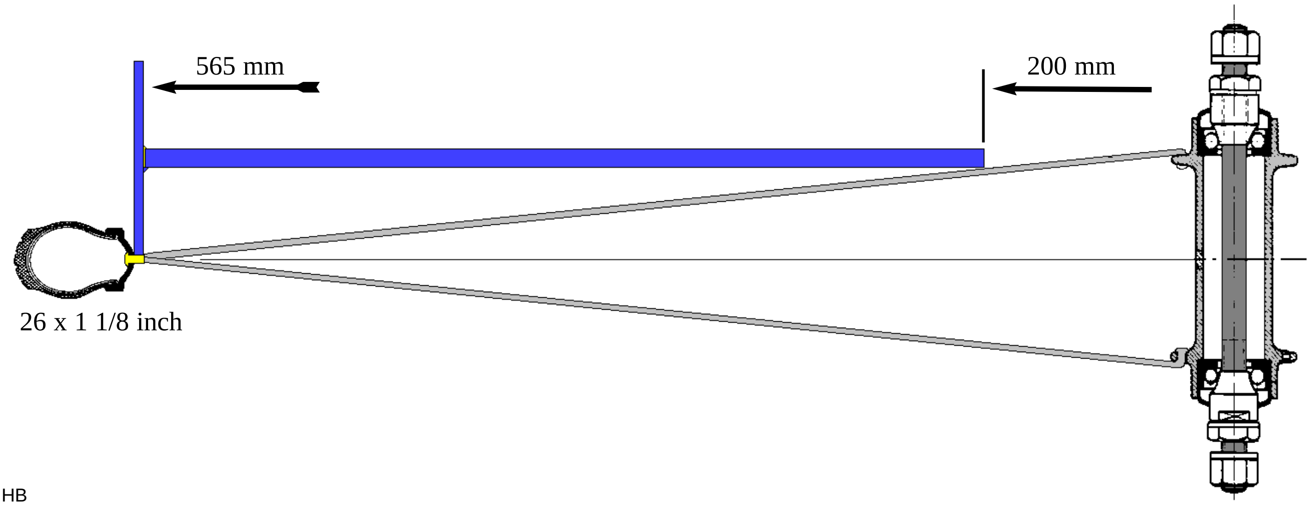
In the Coticule Museum I saw an interesting tool to ease the job. It consists of a round cast iron plate driven by a powerful engine. The Coticules are dressed with sand, which is automatically enriched in the process with garnet particles from ground Coticule material. Given the considerable amount of hones yet waiting to be flattened, I had to come up with something to spare my not-quite-so-young back and muscles. After some thinking, I came up with an old bicycle wheel mounted in a steel frame.
On top of the wheel a steel plate 10 mm thick and 565 mm in diameter, surrounded by a 40 mm wide ring is mounted. The ring has been welded to the plate every 150 mm.

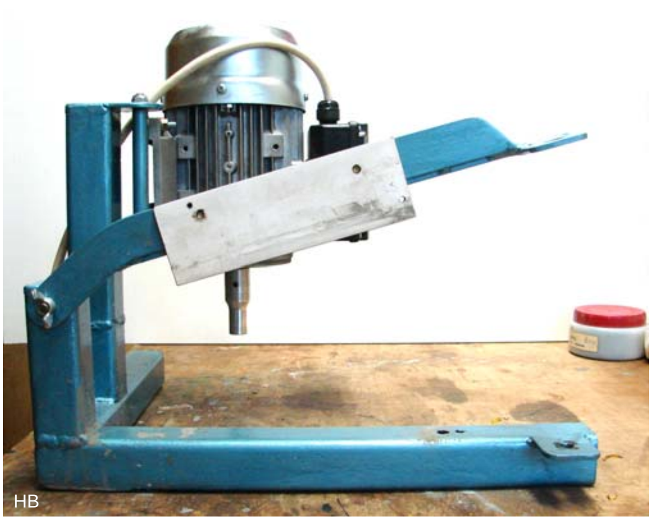
The ring lies neatly flat on the spoke nuts. Because of this construction the plate can be turned up side down. The plate weighs 20 kg and is easy to take off to be flushed with water when a finer grain is to be used. The gap between the welding is filled with epoxy so it is waterproof. Because it has larger bearings I used for my version a rear wheel.



The wheel is mounted in a large steel frame.
A 230 V electric engine of 0,25 kW drives the wheel via a 18 mm steel shaft, allowing for a 1:37 speed reduction to make the wheel go round at a pace of about 38 revolutions per minute.







The upper fork is hinged to allow access to the plate.

The wheel is used with silicon carbide of grit K220 - K600. As it dusts easily, the latter can only be used whet, and that's why I made the outer rim. It keeps the water on the plate and thus prevents any messiness.
The upper fork is hinged and fitted with a leaning rake to rest the stone unto. Therefore, little force is required during grinding.
Dry the plate after use with a cloth to prevent oxidation.



Rozsutec is very hard and not flat at all and difficult to grind



It has deep grooves. (USB microscope)
The scale is 0.5 mm.



After 5 minutes grinding with grit 220



After that after 5 minutes grinding with grit 600



After 5 minutes grinding with 600 grit (USB microscope)
The scale is 0.5 mm

The size of the abrasive grain has much effect on a whetstone. What usually happens is that the tops of the abrasive grains are grinded down. The stone feels smooth but is no longer able to take away much material.
It is very important to recognize the individuality of the stone when lapping the surfaces of the stone. This requires much practice. To show the effect of the abrasive grains on the surface of a honing stone, there are done some tests with Belgian bluestone also called hardstone, freestone, coal limestone or petit granite. The stone industry distinguish the following stages:

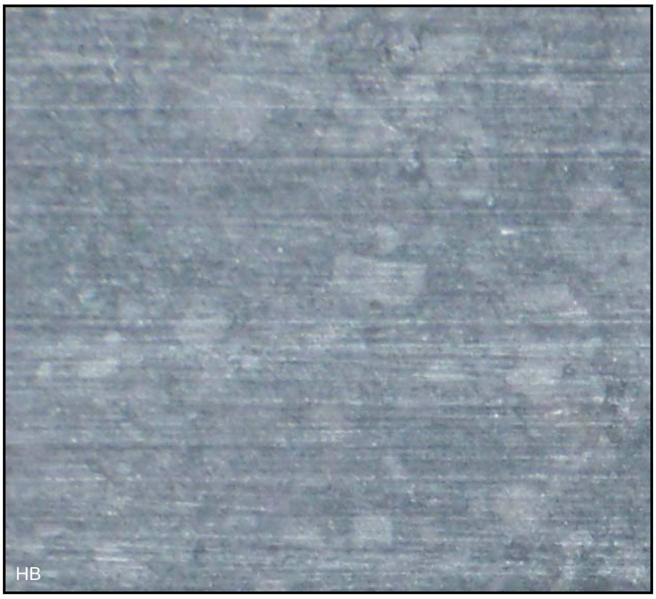
Sanded

The purpose of sanding is to remove saw marks. Dry or wet sanding is done mechanically with silicon carbide (SiC), carborundum, diamond discs or similar abrasives.

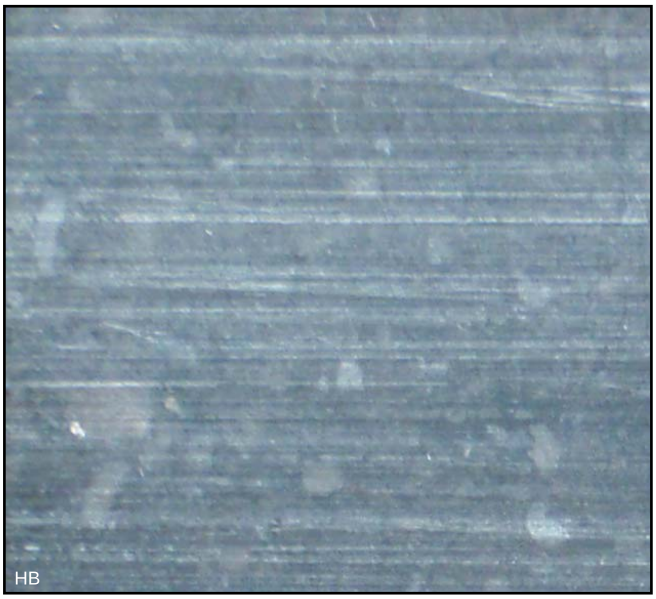
C30 = very clear coarse grinding and saw marks, stone colour and texture almost invisible. (no photograph)



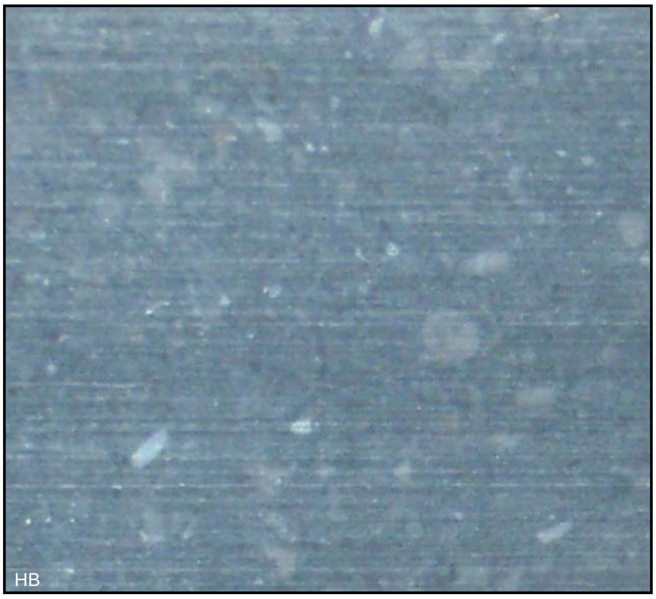
C60 = coarse, abrasive perceptible trace, colour and structure barely visible.



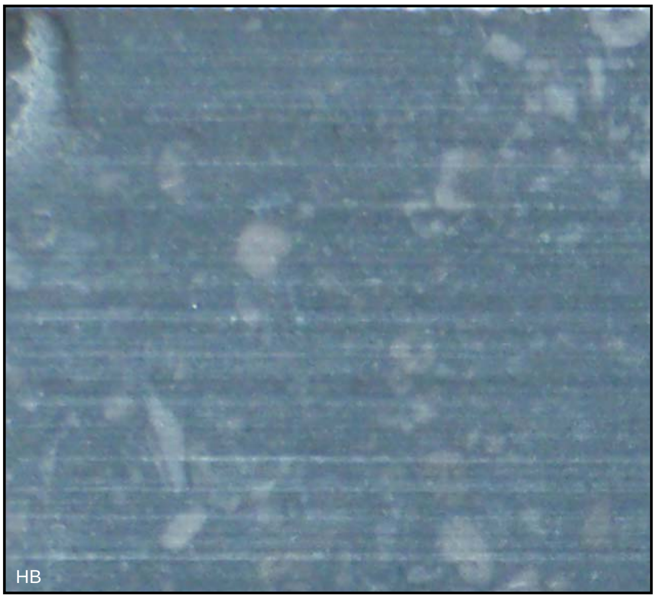
C90 = medium, from top visible grinding marks, rough structures visible, pale colour.



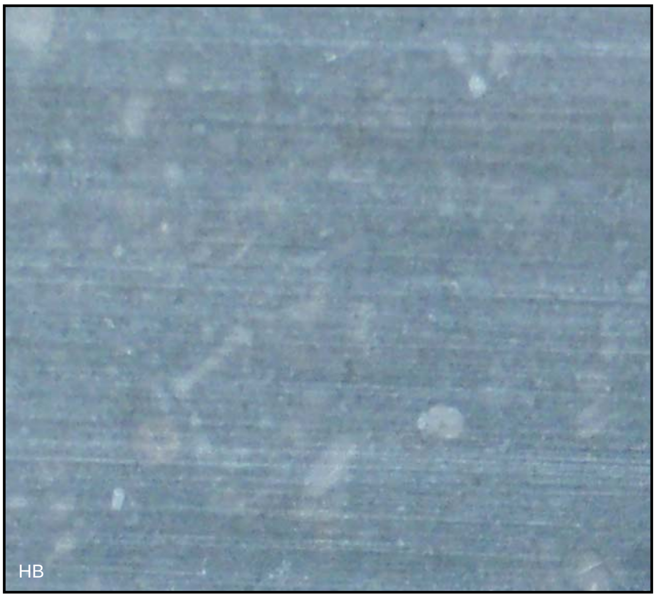
C120 = medium, visible grinding marks, pale colour, texture visible, grinding marks are visible in raking light.



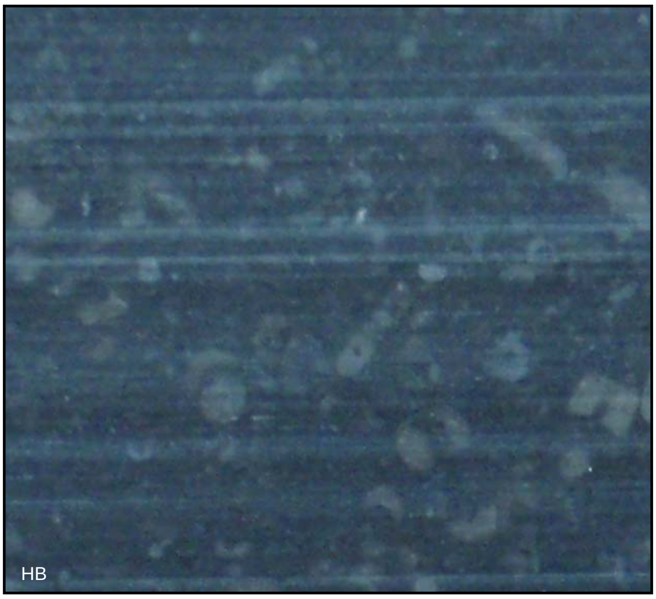
C180 = A clear distinction from previous grinding, feels smoother now.



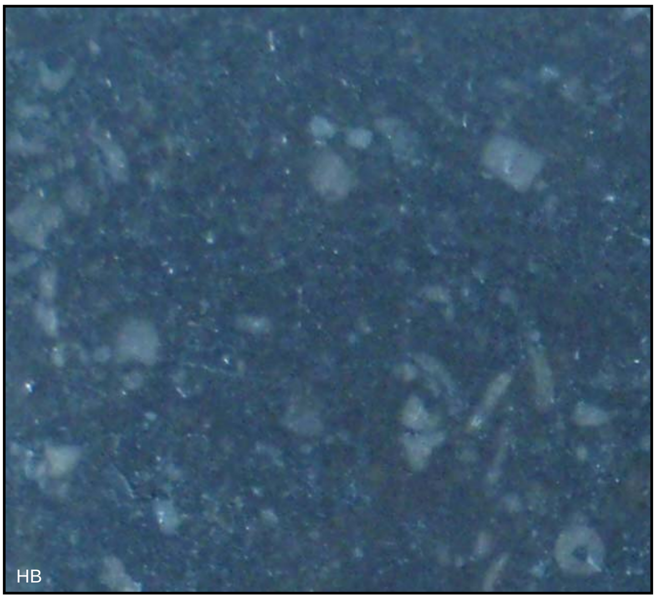
C220 = Slightly honed: fine grinding, colour and structure clearly recognizable, grinding marks still visible in raking light.



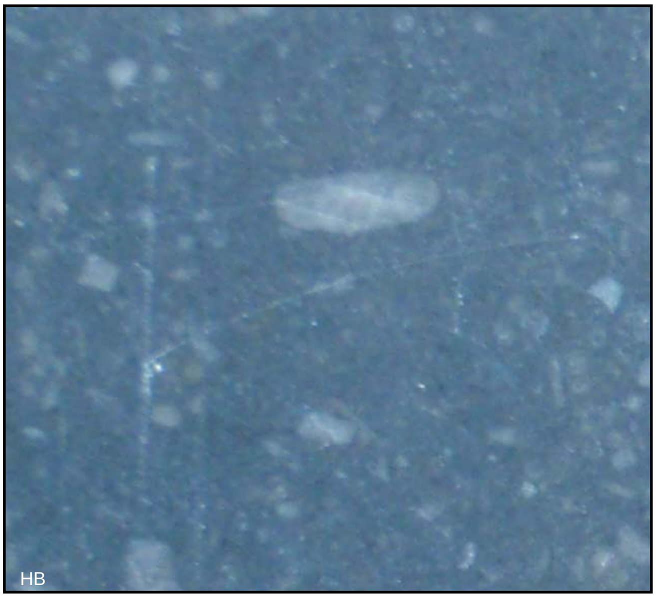
C320 = satin surface, grinding marks still visible in raking light.



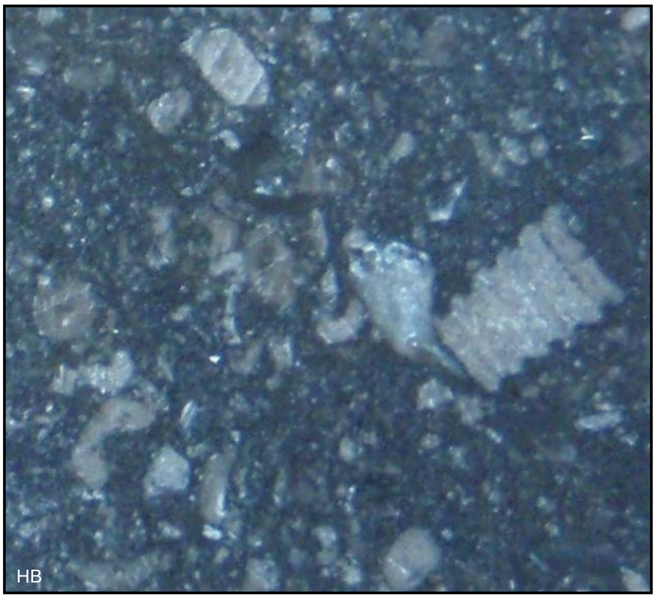
C400 = dark honed, satin, shiny biotit already, grinding marks still visible in raking light.



C600 = satin, almost polished, smallest possible surface, grinding marks still visible in raking light.



C800 = depending on material you can speak of polishing here, yet very small grinding marks are visible in raking light.



C1200 = Polished. Has a very smooth surface.
By polishing the shades take their various nuances, the colours are enhanced, the stone gets a reflecting surface with a high gloss.
Not every stone can be polished. This depends on the minerals present and the structure of the stone. The veins and cracks in some species are exposed.



Lapping machine 2



During a visit to a whetstone maker I've seen this grinder. The green part was familiar to me as part of a tile saw. During our conversation about the grinder I got a used 8 inch (200 mm) "electroplated diamond grinding disc" to try it out.

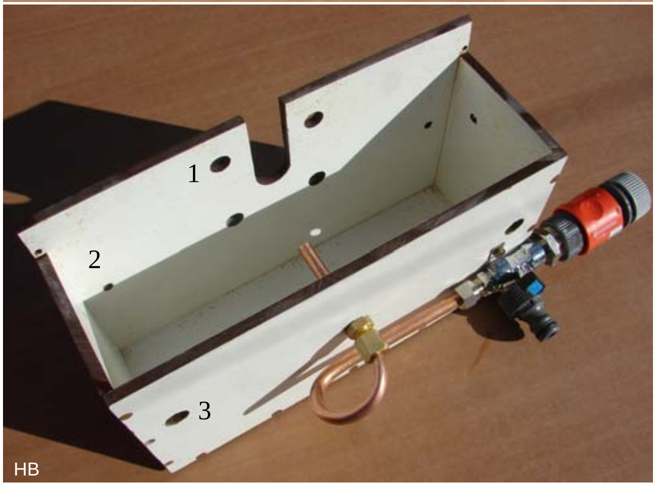


Back home there was an advantageous offer of a Tile Saw at the DIY shop.



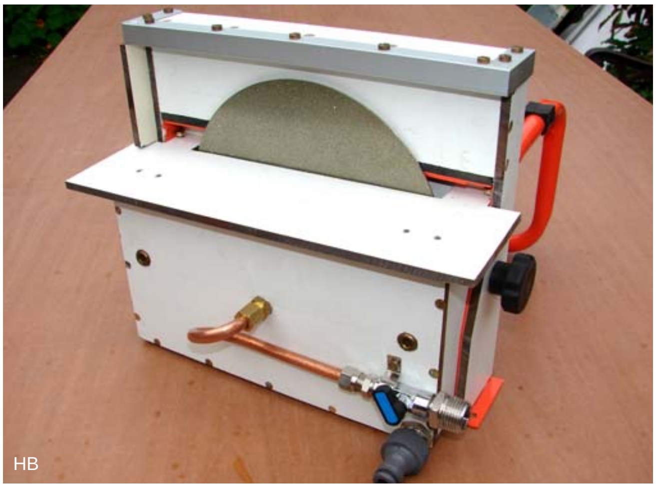
This is stripped to the base portion. The saw is also removed and after reaming of the bore of the abrasive disc to 25.4 mm it showed that it fits perfectly with sufficient ground clearance.

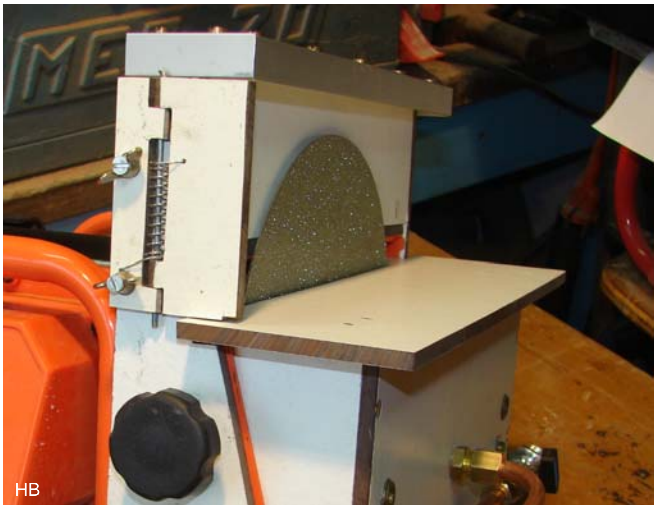




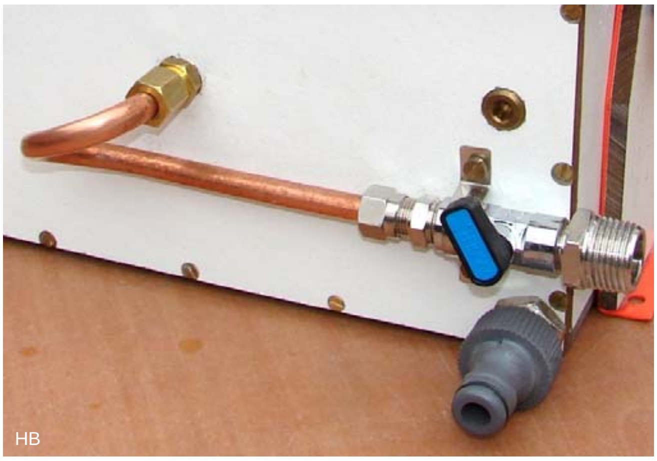
1. Cutouts for the motor mounting bolts.
2. With this the tray is put to the machine.
3. Recesses to be able to convert the locking screws with a socket wrench. They are sealed with a 1/4 "brass plug.

Trespa (HPL, which stands for High Pressure Laminate) is excellent for drilling and tapping. Therefore, it is an excellent material to construct a grinding table.
There are used 3 mm brass screws for construction, complemented with stainless steel bolts and washers.





The diamond discs should be water-cooled to ensure that the disk will last long. There is needed very little water and the speed creates a mist of water. In order to prevent the water from being thrown far away, there is arranged a spring-loaded valve so that even long stone can be grinded. Without valve the water came up to 2 meters.
At the top is an aluminum angle of 15 x 15 mm. This bends the water downwards so you will become not too wet during grinding.



The water is provided by a 12 volt pump.
The yield is too much and can be limited by the mini ball valve. The connections are 1/2 "gas thread so ordinary garden hose can be used which makes connecting and storing easy.



The table is a little bit diagonally mounted to keep the water nearby and can be made square by 2 brass screws M5.

"Electro plated" diamond grinding wheels



Galvanically bonded diamond discs consist of a single layer of diamond grains which are stuck on the disk by a hard nickel matrix. The tough bond enhances the cutting action by the optimum diamond exposure.
The standard diamond discs have a high concentration of small uniform and equally large diamond grains which are evenly bound by the nickel layer on a thin flat spring steel carrier.
They are available in a wide range of grain size from 60 to 1200 mesh for eg grinding or polishing stones.
Almost all disks have a shaft hole of 12.7 mm (1/2 ").
It is useful to have made special flanges for mounting.
For my machine is used a 8" disc with a grit of ~ 100.



In this arrangement, the water is raised by a submersible pump to the grinder. The return water comes in bucket 2 that overflows in bucket 3, which in turn runs into bin 4.
The buckets serve as a settling tanks.
The residue in bucket 2 is coarser than that in the bucket 3 which, in turn, is coarser than that of the sediment in the tank 4. In this way, the pump still deals with reasonably clean water to keep the wear within limits.
According to hearsay plants do well with the sediment (bentonite) from the buckets.
But this you may find yourself.

DIY whetstone



Introduction

Who has not once looked at a slate tile and wondered if it would be useful.
I found the following in "An Introduction To Geology" by Robert Bakewell

"Whetstone slate, or hone, is a variety of talky slate, containing particles of quartz. When particles are extremely minute and the slate has a uniform consistency and requisite degree of hardness, it forms hones of the best quality."

This tells us:

Slate for a whetstone or grinding stone is a slate with small particles of a quartz variety. If these quartz particles are extremely minute and uniform in size and has the correct hardness of the bond, it is suitable for whetstones of the best quality.

Slate really only is useful from step 5 to 8 (argillite, fyllite, slate and schist. (See: slate on page 10.) Besides slate, you have very fine grained sandstone and, of course novaculiet useful as material.

Teaspoon



A convenient method is to test the grinding quality of a stone is by rubbing a stainless steel teaspoon over it.
You can feel whether the stone is 'grippy' and the surface finish on the convex side of the teaspoon shows whether it is a bevel setter, a whetstone or a polishing stone.
A bevel setter is a stone you use to make the correct sharpening angle. This is usually fine sandstone.
Try the teaspoon test on a few known stones to gain experience. A coticule feels a lot different from a Dragon Tongue from Wales.
Also test a normal boulder with a good appearance.
Recently, I cut a slate boulder and ground it, finding it has a surprising quality. The scratch pressure is 1000 grams, and the grinding pattern is equal to a good polishing stone.

Tools



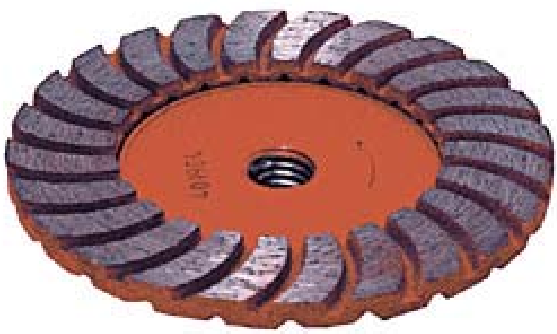
* Goggles to protect your eyes: you do want to be able to see the result of your efforts?
* Dust mask: to be able to utter cries of delight even later.
* Ear protection.
See:
http://bds.home.xs4all.nl/info_artikel/12c_geluid_info_20m-24.pdf
* Leather gloves not to injure yourself when the grinder slips.



* Large vice with wooden clamps.
* An adjustable angle grinder with diamond blade is indispensable to cut the larger pieces into manageable parts. For me the speed is controlled with a Variac.
To prevent tampering with cooling water the speed is approximately reduced by half. See:
http://www.circuitsonline.net/forum/view/48194

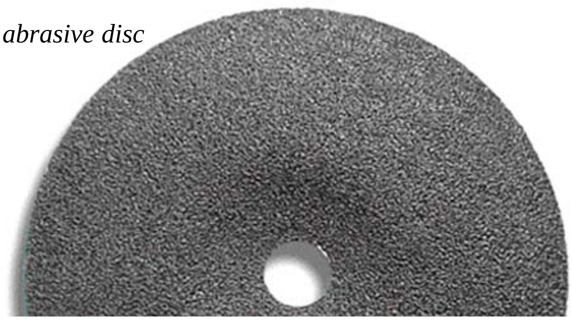


* Tile Saw to cut perpendicular sides.



* A diamond cup grinding wheel for the stone surface.

SiC abrasive disc



* SiC abrasive wheels for grinding stone smooth at low rpm.
* Dust extraction to protect your respiration.



* Copying pencil Koh-I-Noor 1561/e for marking.
This tip I got from the last whetstone maker in Slovakia. During the operation, the pencil lines stay visible, also with the use of water!

The procedure
Examine the stone thoroughly for defects and fractures. On tap, the sound should be clear.
If it still cracks during processing than at the end of this story you can find on how you can solve this problem.

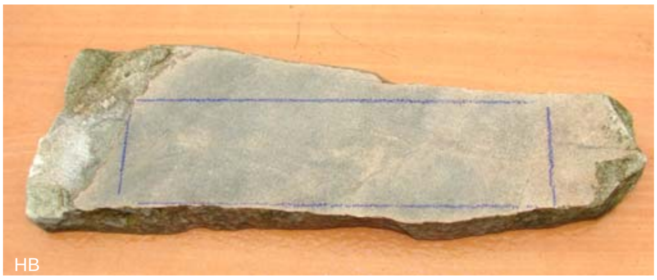


This fine rough piece of sandstone comes from the Wetzsteinstollen Jux, a deserted mine in Spiegelberg, Schwäbischen Wald. The hard lumps of fine sandstone were laid aside for making whetstones at home after work at the mine.
In order to determine the quality, this piece is taken home and processed into a whetstone.
On the blue lines the stone is cut, and with a wedge, the parts are separated.





The fracture surface.



With the tile saw a rectangle of 20 x 5 cm is cut out



The stone is levelled as good as possible with the flex
A cup wheel works better, see the next page where I tell something about grinding.
On the lapping wheel the bottom stone is flattened with sand as an abrasive. The scratch resistance of the stone is quite high, namely 1200 grams!



Others did this grinding with silicon carbide grinding bench stones and elbow steam. The stones were increasing in fineness. See http://lumberjocks.com/Daren/blog/2835
The Spiegelberg sandstone is hand finished with a SiC waterproof sandpaper sheet with a grit of 600.

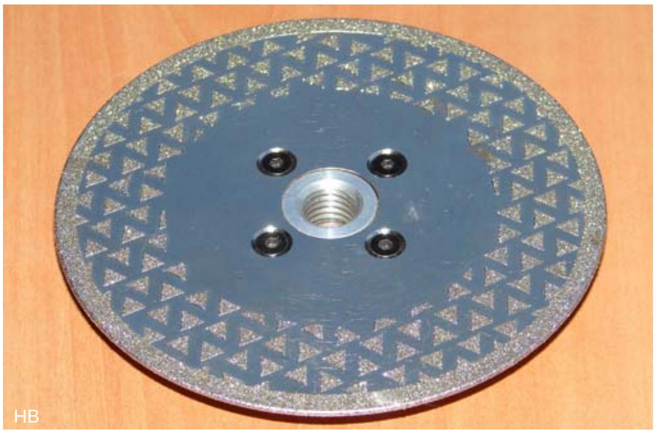


To gain practice and to be able to compare, these stones are handmade in the described manner.

Level and square cutting with the angle grinder



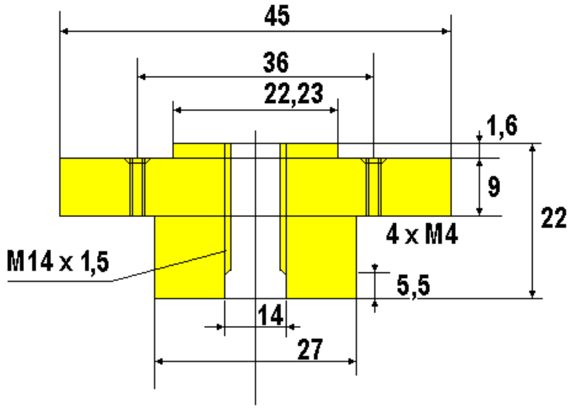
Here is tried to level the rough stone surfaces with a saw in the angle grinder. The result was very unsatisfactory.
Reason enough to have a look around in the internet to see what companies are using natural stone. We were referred to the firm Stone Tech in Zeist. After having explained what we were doing we were shown what they had in their program. In their program they had a diamond cutting / grinding wheel mounted on an aluminium gradient with thread M14 x 1.5. As a result, it is possible to use it as a flat grinding or sanding disc plane.



This is a construction with possibilities: The disk can be replaced by a cheap blade (DIY Praxis) so you can grind also at low cost.
The disk is nickel platted, meaning: a nickel layer on the disc attaches the diamond crystals.

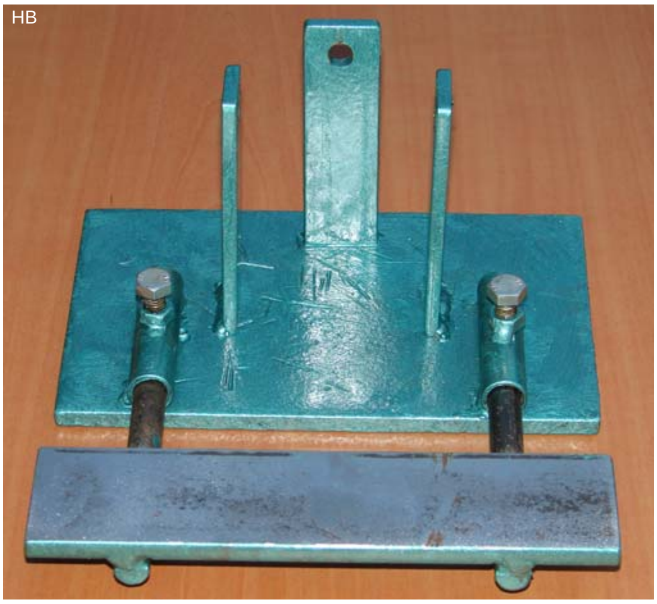


The thickness of the nickel layer is about 50% of the grain diameter. The crystals are thus held firmly but are stabbing from the binding, so a very open granular structure is formed. This disc is very good to use for relatively soft stones like marble and slate. For hard materials a resin bound cup grinding wheel has a longer life, see page 45.
Optimum cutting speeds: dry 8 to 18 m/s, wet 15 to 30 m/s. Converted to dry about 1500-3000 rev/min.



HB

The length is adjusted on my grinder.



The Aldi (supermarket) grinder has 3 mounting holes of M 8. The stand for the grinder is made of some old iron from my junkyard. Make sure the tool rests perpendicular to the cutting surface. All that's missing now is the dust extraction. See also page 50 of the catalogue:
http://www.beeldhouwwinkel.nl/catalogus_2011.pdf





Beeldhouwwinkel (Sculptors shop)

Diamond with a galvanic bond, grain 40/50. For limestone, marble and soft granite-look-alikes, KGS.



Beeldhouwwinkel (Sculptors shop)

Thin, non-flexible pad with M14 connector for fiber adhesive discs.

After grinding to shape, you can grind the hone to become a bit smoother with silicon carbide (SiC) fibre adhesive discs. I use discs with grit 220.
Regrinding I do on the big wheel with grit 600 and final polishing is done on a SiC waterproof abrasive paper on the granite slab.



The spectacles become dimmed because of the dust mask so it is difficult to see the piece of work well.



With a dust extraction work is much more enjoyable.

Glueing

Even if you do ever so careful there always may go something wrong. Happily this does not have to be a problem. With a little 2-component adhesive it soon is back in its place. For this job I use UHU plus 2-component glue. It is very easy to use. Put from each tube an equally large drop side by side on a piece of cardboard and stir with a matchstick until the mixture is smooth.
Smear on sides of the break and firmly press the 2 parts together and secure with the help of one or more thick rubber bands. Let cure for 24 hours than remove the excess epoxy with a piece of coarse emery cloth and then finish it off with a finer sandpaper of at least grit 600.
The glue joint is often not even visible.



The white line is a natural fracture.



Fracture surface of a slate boulder.



After gluing: the bonding has no effect on the grinding or the cut.

A thin layer of glue is important during gluing. With the boulder it shows that the adhesive layer has been too thick. At stone 273 an adhesive clamp could be used, and the result is that the adhesive joint cannot be seen.



These broken coticule can be repaired virtually invisible by gluing carefully.
Put a piece of cellophane on the surface of the granite lapping-slab. The adhesive does not stick to cellophane.
Glue the coticule parts under pressure the top down so the glue line gets as thin as possible.
The cellophane ensures that the adhesive joint is fully filled at the top by the setting adhesive.
After the curing the coticule at the bottom and the phyliet at the top must be lapped with grit 220-240. Glue the coticule and the phylite together and finish the stone.



In Burton Rox times (1986-1998), a beautiful yellow glue (Araldite) was used to glue the planed coticule on a slate tile.



After 1998, another adhesive was used with a more grey appearance. The differences are obvious.
See also:
http://www.coticule.be/faq-reader/items/how-can-i-repair-a-coticule.html

Water or oil

It is for many people a question: do I use oil or water for my whetstones. In general it is true that oil is used for the porous stone and water for the stones with a closed structure. A well-known example is that Coticule is used with water. The coticule has no pores so that also there can no iron particles get into the stone. Spit works even better than oil. Many think is is a bit odd, but it has been long the practice with carpenters and joiners.

The advantage is that it always at hand nor freezes. Saliva contains enzymes that gives the impression that the mass thickens at compression and thus a better slurry is formed. Any rust problem was solved by rubbing off the tool with a piece of bacon. The bacon was also used to lubricate the side of the saw so it would be running better. Teflon was not yet known!

Tallow was also used, see:
http://bds.home.xs4all.nl/info_artikel/19_vethoorn.pdf
In Limburg, they used a rod cut from the pig to lubricate the blade. In other words, with a pizzle (thymus) saws were greased. Sometimes the tail was used for this purpose.

Oil holds the iron particles better than water and by cleaning the stone after each use with soapy water the surface is kept clean easy. Some get off the iron by running a magnet over it.

Wiping with a cloth, has the disadvantage that the iron particles are rubbed in the pores, and able them to get stuck.
The wipe is also done with a little oil to remove the dirt easier.
Unfortunately there is no optimal solution, so you may try for your own stones a few things. Remember that the liquid is to compare similar to the drill oil metalworkers use for a better result, works faster and prevents the cutting tool to become blunt. In this case, your hone is your cutting tool!
Never grind or hone with a dry stone.

Demands to the liquid
Long ago there were only natural grinding and polishing stones. There can be distinguished 2 main types: the stones with open pores and stones without clear pores.

During the grinding it is desirable that blunt grains break out of the binding, and fresh-cut grains are available constantly. Dull grains give more resistance and ultimately the force exercised will be so great that they let go. The purpose of a liquid is to carry off the removed metal and also, secondly, to carry off the loosened abrasive grains.

Some important terms:
* The liquid has to be thin enough in order to ensure that the metal can be reached by the abrasive grains.



* Fine stoned need a thinner liquid, since the peaks of the abrasive grains are relatively much lower than with a coarse stone.
* The liquid must not become gummy and form a hard layer that will block the stone and the grains. For dirty stones, see section '5 d Cleaning dirty stones "on page 29.
* The liquid must be able to include the swarf formed.
* Stones from the same quarry and from the same layer, may differ in composition and need an other fluid. Advice from forums are useful, but may occasionally miss the mark completely.
* The finer the liquid the more accurate you need to work.
* The lubricating effect is important. Water is pretty skimpy and machine oil is unusable. It is recommended that this issue should be thought over thoroughly.
* Historical recommendations are usually not feasible any more. How do you get sperm whale oil?

Water stones
Water stones take off faster but also wear out faster. Known water stones are Thuringer and Coticules.I use only water for all natural stones to avoid a mess.

Oil stones
Known oil stones are Novoculite stones like Charnley Forest, Arkansas and the Turkish Candia Vera.



Oil is also used on the Llyn Idwal stone and there seems to be a significant difference between the results of the use of water and oil.

Use of a slurry
Thuringers and coticules perform significantly better with a slurry. With the help of an extra bit of stone preferably of the same material, a thin-liquid paste is made in which a portion of the stone is absorbed in the water. The freshly released particles are sharp!
With the help stone also called slurry-stone, the grinding or polishing stone also kept level by proceeding with consideration. In the absence of a stone of the same material also may be used a Nagura.

The grinding operation is than lapping, see Part 1 Chapter 2 "sanding, grinding and lapping" on page 12.

The disadvantage is that the surface becomes dull. To reach the final finish can be worked without a slurry, and there will occur a high-gloss. Make no big jumps between grain sizes but go step by step to a finer grain.
There are always at least needed 4 steps for a sharp tool increasing the grinding angle every time.
1. The fitting of a cutting angle (setting the bevel). Damages are removed.
2. Grinding. The rough cut is smoothened.
3. Honing. Burrs are removed.
4. Polishing. The surface of the cut is made mirror-finished.
See the internet where you get flooded with demo's.

Which oil
Here the number of people determines the number of opinions. A few drops usually is enough for a good grinding operation. Wipe dirty oil regularly and replace it with clean.

Always clean the tool after sharpening to avoid the wood or your chin is tarnished by a black smear and do not forget to wash your hands. Spend some money to an assortment of oil and look for the best combination for you. Sometimes too thick oil is diluted with a little kerosene or turpentine.

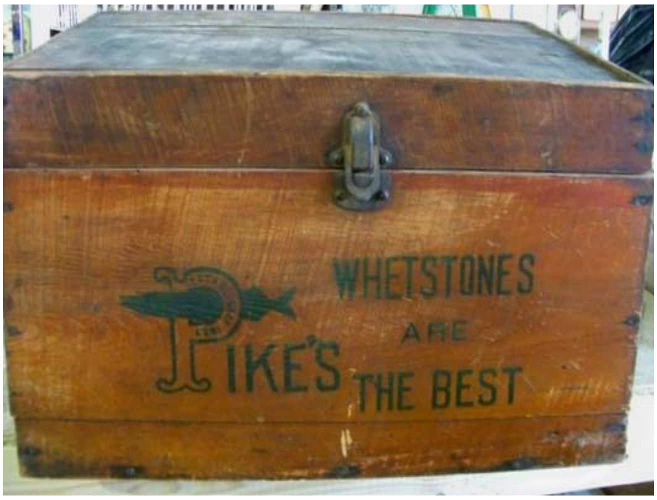
WD-40 may be too thin and 'Smith Advanced Formula Honing Oil "may be too thick. The oil of Norton is a little in between. Attention! The thickness of the oil may vary with temperature!

If you sharpen knives for the kitchen it is wise to use edible oils.

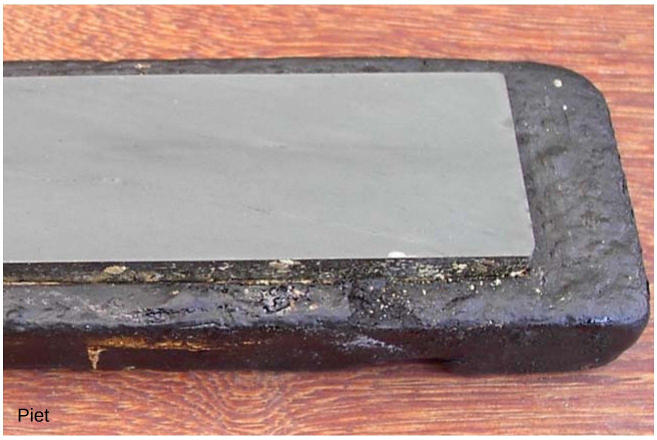
* Baby Oil can be compared with thin mineral oil. It is easy to obtain and it even smells good. Sweet almond oil is a fatty oil consisting mainly of triglycerides. This base oil is suitable for all skin types is widely used in cosmetics such as cream and baby oil.
* Ballistol is used for the maintenance of guns and knives. Is an edible oil and easy to use.

At the end
After grinding or honing the stone must be cleaned.
If during the grinding and honing oil is used, you can also use this oil to cleanse the stone by putting a small amount on the stone and clean the stone with a circular motion from top to bottom.
You will see that the metal particles come from the pores. Wipe off the particles with a tissue or cloth.
Then rinse the stone under running water and dry the stone with a tissue or cloth. If the stone after sharpening and honing are not cleaned, the metal particles on the surface dry and the pores become clogged.

Keep your stones clean and safe; boxes



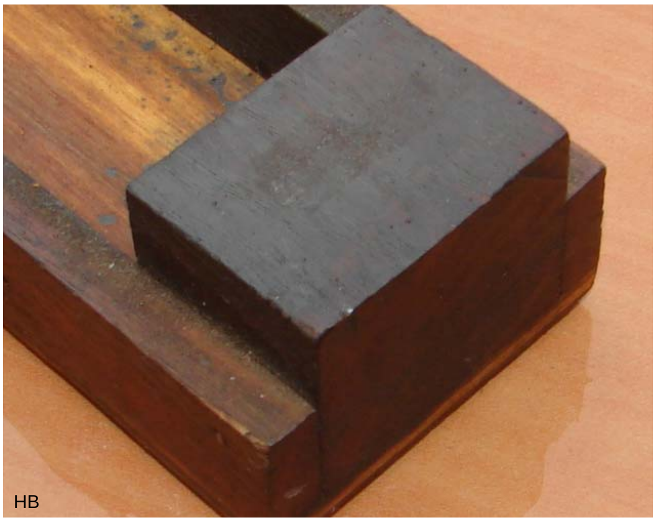
It will not go unnoticed that good natural whetstones are rare, so the prices are very high sometimes. Therefore, it is necessary handle them with care.
* One of the biggest risks is that the stones fall, or break under the pressure of the grinding.
* Many stones are not flat at the bottom.
* A dirty stone is cannot be used good. Therefore they must be prevented from becoming dirty.
* Oilstones can be quite greasy.


Piet

In order to avoid any risks it is better to make an appropriate housing for each commonly used stone, in the form of a box. There are many variations possible so create your own stamp upon the design. Previously you had to work a week before you could buy a good whetstone. Therefore, one of the first chores of a carpenter apprentice was making a whetstone block.

Many stones come in a cardboard box or are wrapped in a piece of paper that eventually supplies no protection. Some old stones come in a wooden box that almost falls apart of misery and is too filthy to be handled. To use this in the same space as natural wood is asking for trouble.
Whetstones used for sharpening a razor can be contained in a very nice mahogany box. This can be so beautiful that sometimes it may be found in an interior as decoration.

Making a whetstone box
Choose a wood species with a fine filament, fairly hard and free of knots and the like. Preferably, a wood that absorbs not any oil or water, is dimensionally stable and does not splinter. Choose for the dimensions 4 cm longer and 2.5 cm wider, and for each part approximately the same thickness as the stone.


HB

Sometimes at the beginning and the end of the stone a piece of wood is placed which is the same height as the stone so when the grinding the cutter a longer stroke can be made.

Fit the sections together and if it is to your liking, mark both two parts so that they always will be tried in the same way: the so-called pairing. Determine which part will become the top and which the bottom, mark this too.

Mark left and right on the stone and do the same with the inner parts of the wood. Mark the circumference of the stone on both parts and make sure that the correct part is used. Determine the desired depth for both parts and mark this on the timber.


HB

How you make the cavity in the wood depends on your tools. Previously this was done with a centre wood bit, but now I should use a router.

Often the form is custom made with a chisel or as the Americans say an "old woman's tooth."
In case of stones with an irregular bottom take account of the filler to secure the stone on the base component.

Ensure sufficient space exists to allow the wood to follow the changing of the seasons with expansion and contraction. It would be a shame if a beautiful box that took much work and creativity was burst because the stone did not want to give in.

The cement
Traditionally putty was used here. Mixing linseed oil and lime flour until a putty like consistency arises easily makes this.



In English whetstone boxes you may find white- and red-lead is mixed in. The reason for the red-lead powder is that it prevents the stone absorbing the linseed oil. Sometimes heated glue of bones is mixed with red-lead powder. I also found a form of Plasticine.

Finishing
The upper side can be made only after assembly of the stone. If the top fits the sides can be levelled by scraping or sanding. Planing gives a much smoother surface!



Apply a bevel (bevel of 45 º) or rounding so there are no sharp edges. For the finish or design you can choose from the many examples in this story.

Use a hinge or clasp for optimal protection of the stone. A closed box does not open automatically in the toolbox with all belonging risks.



In this whetstone box there are 2 handling closures made so the lid can be easily removed.



Also 2 nails, with their heads cut off, were driven into bottom for use on the bench to ensure footing during grinding.
A better idea is to put rubber feet under the box.
The friction of the rubber feet prevents sliding on the bench during grinding. Wiping with a cloth easily cleans a high-gloss lacquered box.

Remark
Do not keep a light coloured whetstone on a rubber or plastic whetstone holder. It is likely that the stone is permanently discoloured on the contact surfaces.



These stones are most often used by me.
The stones come from Joseph Grogna (Burton Rox).

Models of whetstone boxes

On a shelf



Arkansas chunk glued to a coromandel board.



Probably the carpenter could not find a better board ..

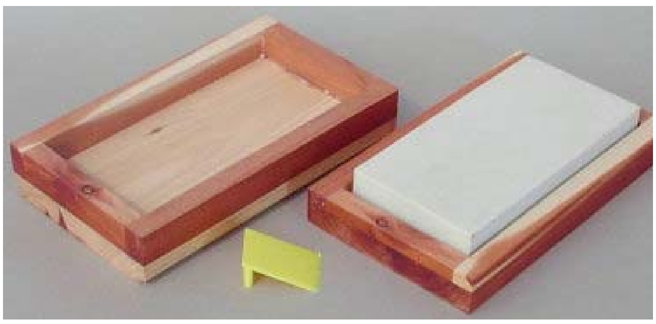
This is a lot better.





This stone can also be used on its side.

A board with slats



Simple construction of cedar. The stone is loose.



A board with mitred hemisphere.



Sides mitred.

Glued to a paddle









Special whetstone boxes





A nice piece of shrine cutlery. Under a sliding there is room for a razor. The lid has a leather lining that is used as a strop. The whetstone is released by sliding off the cover.



A nice piece of millwork intended for a coticule. When the box already is so beautiful you naturally are careful with your stone.


















HB


HB


HB


HB


HB


HB


HB


HB


HB

Database

Why a database?
There are several ways to preserve data. It is obvious to save them in text files, but that has major drawbacks.
The bigger the text, the lower the speed the correct information of an application can be found. Especially if your data have a complex structure, it is often difficult to program text files. These problems are easily avoided if you use a database.
A database system is optimised to transfer and efficiently store and ask data again. Also, data are easy to structure, which facilitates the programming.

The goal is a determination table.
Before making a determination table many structured data are needed and a method of posing questions. Text files are not suitable nor a spreadsheet, because it is designed to count.

What data is interesting
Which data are interesting
On the SRP forum I came to the following:

Name: Short term please.
Provenance: Which country it comes from.
Model: Bench hone, on a stand, combination hone.
Dimensions: Please enter in inches or centimetres: length, width, and depth. Please include the unit of measurement.
Grit Size: Please make sure you enter the right value accordion to JIS.
Cutting Speed: Does it cut quickly, or do you need a hundred strokes?
Feedback: What tactile or auditory cue does the stone give when honing?
Lapping: How frequently does the hone need lapping?
Soaking: Does the hone require soaking prior to use?
Geology: Slate, Sediment, Crystalline, or other.
Hardness: Use the Mohs scale to give us an idea about the hardness.
Cleavage: The way a mineral breaks.
Slurry: What colour?
Image: Upload a good crisp picture without decoration please.

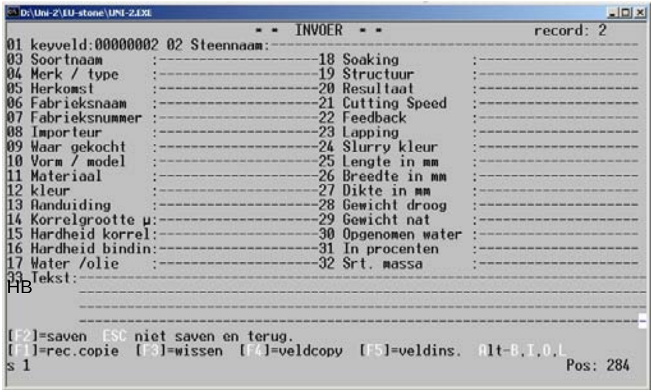
If you don't have an answer for one of those fields, please enter "n/a" and submit your hone anyway.

For our purposes, a lot of information is missing so we had a look at the information present in the old Straight Razor Hone Database (SRHDB).

Unfortunately, this data file has been removed by a miscreant (vandalism) on September 20, 2010.
Luckily I made a copy in time in text form so the information it contained is still accessible.
A page is included as an image in this story.

Card box
Already in 1982 I built my first card box (the simplest form of a database) using a crude form of Basic to register my collection. This language is reviled by many but happily still is available. The then available database packages were - for this amateur - too expensive.
Since then, many modules have been added to it and it is able to run independently as a card box program.
We are now many versions further and the data (content of the card box) is accessible in many ways.
UNI-2 is a matrix-driven data handler. The capacity is 32,676 records
A lot of programs wil do the same job.

Matrix
The matrix includes the structure of the database and size of the fields. All fields together form a record.
It is important to fill the fields in a consistent way to prevent that you do have data with information but cannot get information out of it.



The fields are as follows (description):
@ 0 - Is for the conversion module used to detect a new record. @ Is used to detect a field.
@ 1 Number: In my database field 1 contains a unique number corresponding to the number applied to the stone and also in the name of possibly photos and text files.
@ 2 Stone name: The common name for the stone.
@ 3 Species name:
@ 4 Brand / type:
@ 5 Origin: Country Display in 2 letters supplemented by province or territory.
@ 6 Factory Name:
@ 7 Serial number:
@ 8 Importer:
@ 9 Purchased from:
@ 10 Form / Model: See Chapter 5 Designations.
@ 11 Material: Geology - igneous rock, metamorphic or sedimentary.
@ 12 Colour: Colour Patterns. Take pictures of the stone - preferably the entire stone, recording a macro and a micro.
@ 13 Designation: Coarse / fine. See table at the start of chapter 5: the difference between grinding, honing and polishing.
@ 14 Grain mu: Honing and grinding stones have no grit. At the most can be specified with which it corresponds.

A page from the former SRP Straight Razor Hone Database (SRHDB)
now http://straightrazorplace.com/srpwiki/index.php/Category:Hones

Coticule, Natural Combo, Kosher

Name	Coticule, Natural Combo, Kosher
Provenance	Belgium
Model	Combination
Length	5.0
Width	2.4
Depth	1.0
Unit	in
Grit Size	8K-10K
Cutting Speed	slow
Feedback	Soft and gritty for a coticule, but still smooth
Lapping	rarely
Soaking	not required
Geological Group	Sedimentary
Mohs Hardness	Don't know Mohs, but softest of my coticules
Chipping Mode	
Slurry Color	Milk white
Image	

Retrieved from "http://www.straightrazorplace.com/srpwiki/index.php/Coticule,_Natural_Combo,_Kosher"

@ 15 Grain hardness: Natural whetstones mainly depend on quartz for their hardness. Harder minerals are rare in a whetstone. The Mohs scale is not suitable for natural whetstones. Since the database also contains artificial stone, this field is applied.
@ 16 Scratch Resistance grams: scratch-ability in grams for a scratch of 0.3 mm. This gives an impression of the strength of the bond. Binding is also known as matrix or cement.
@ 17 Water / oil: In general, the porous stone are used with water, and stones with a high density with oil. Some porous artificial stones are already filled with oil in the factory.
@ 18 Soaking: Has a relationship with field 17.
@ 19 Structure: Mosaic - layering - stripes - bands - layers - open - close.
@ 20 Result: Is dependent on the particle shape, and the hardness of the binding.
@ 21 Cutting Speed: Is dependent on the particle shape, and the hardness of the binding.
@ 22 Feedback: How does it feel during grinding. Is subjective.
@ 23 Lapping: With a soft bond, the abrasive grains break out faster and stone will become concave.
@ 24 Slurry colour:
@ 25 Height in inches:
@ 26 Width in mm:
@ 27 mm in thickness:
@ 28 Dry weight (g):
29 @ wet weight (g):
@ 30 Absorbed water (g):
@ 31 In percentages:
@ 32 Specific mass: Density
@ 33 Text: Anything that does not fit previous fields, can be mentioned here. When the field is full, an automatic text is added, which can be supplemented by any text editor.

A database is indispensable with more than 300 honing and grinding stones, as it is not possible to remember all relevant information.

Numbering stones

Objects that belong to a collection should be numbered. The aim of numbering is the identification of an object: by means of the number, it is possible to establish a relationship between the object and the information recorded about the object.
For practical reasons, first is made a temporary number in pencil: the serial number. Thereafter a final number is provided, the number corresponding to the record number in the database.
The final number means in this chapter the application of a number that can serve the goal for a long time, but in a way the number can be removed if necessary.

It is important the inventory number in principle is inseparable from the object. There should be created no possibility for misunderstanding about the identification of the object, so no duplicate numbers and no complex numbers. Moreover, the number cannot accidentally be removed.

Material

Make use of responsible materials in the application of the number.
This means that the characteristic should remain seated long and must be reasonably durable. By the use of oil or water, it is important that the characteristics are up to that, and the characteristic stays as long as possible on the stone. Therefore, use sustainable materials that are light fast, non-discolouring, not bleeding, fade, flake or peel.

Never use adhesive stickers or tape, nor nail polish, random markers and the like.
The composition is not precisely known then. The ink of pens and markers can fade. Stickers can lose their adhesion power and release from objects, meaning the relationship between object and description (by number) is broken.

Reproduction

- Numbers preferably should be always in the same colour, which properly contrasts with the colour of the object. Usually is chosen for a number in black letters, but the number can also be made in white numbers.
- A number should be as small as possible, without compromising readability. The aim may be a maximum width of 1 to 1.5 centimetres, or so much smaller as possible, for large objects. Put a small number (a few mm ^{2}) on a small object.
- A number is installed in tight figures of the same type. So: no hard to read curly letters or Roman numerals.
- Some numbers can be read in different ways. To avoid confusion, these can best be underlined or provided with a point. Number 108 is on its head read as number 801. About number 108., or 108 there is no confusion possible. This is also the case, for example, for the numbers 66 and 99, 606 and 909, 106 and 901 or 601 and 109.

Position

It is easy when the place of the number consistently is followed. Number as much as possible on the same side, so the nature and location of the number can be found or interpreted quickly. This prevents extra handling of the object.

The numbering in practice

Prior to the numbering of an object is started, preferably there is made a template. This ensures that the number always is applied in the same place.

- For rare and / or expensive stones is the use of gloves recommended to prevent grease or sweat stains, preferably powder-free ones. You can also take cotton gloves on either hands, or the hand you support the object.
- Preferably do not wear clothing with loose sleeves and (large) jewellery, watch out for dangling reading glasses.
- Provide a clean desk with sufficient space.
- Make sure the objects can lie quietly and safely during the drying process.
- Provide the table eventually with a soft layer of polyethylene foam, MAF (Museum Art Foam) or bubble wrap. This for instance may prevents you from having to lacquer the living room table again.

Markers that have proved their value for making an inventory number: Edding 1800 profi-pen 0.5 mm, Pilot ultra fine no xylene SCA-UF, Rotring Finograph 0.4 pigmented ink (all black) and Edding 780 paint marker (white).

Practice



With a pencil through the template a mark is applied.



In this frame a substrate is applied with correction fluid. I have also conducted experiments with wall-paint, thinned with a little water: it is easy to apply.



The number is applied using a permanent marker, and colour-fast markers with a point of 0.2 mm.
After drying, it is finished with a layer of non-shiny Glitsa (a water bound lacquer).

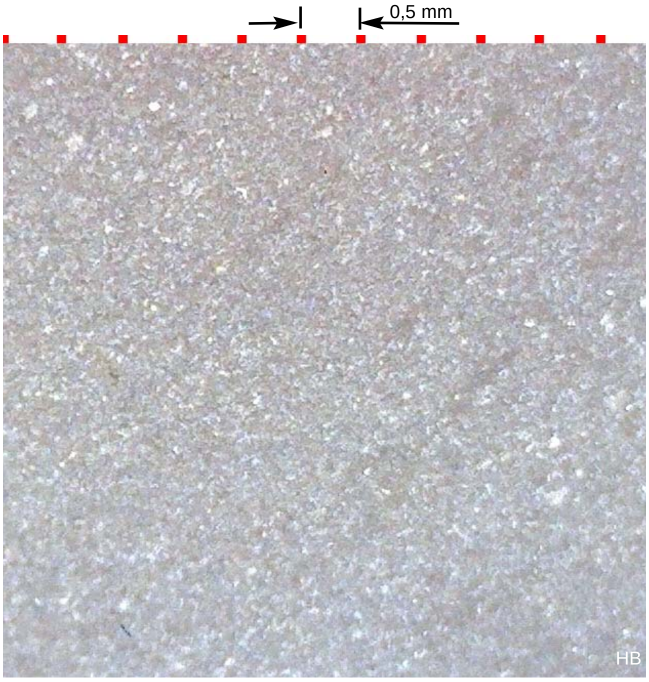
Even after a year lying outside, the number is still easily recognizable. Since my whetstones are stored in a dark closet this will be sufficient for my purpose.

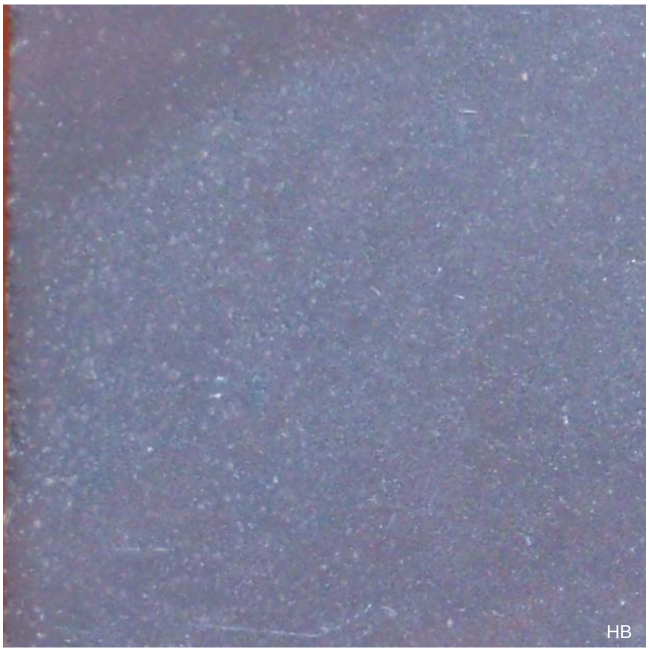


Page from the database EU-stone

@0 213

@1 Nummer : 00000213
@2 Steennaam : **Dragon Tonque rood**
@3 Soortnaam : Finisher
@4 Merk / type : Inigo Jones
@5 Herkomst : Wales
@6 Fabrieksnaam : -
@7 Fabrieksnummer : -
@8 Importeur : Henk
@9 Waar gekocht : Inigo Jones
@10 Vorm / model : banksteen
@11 Materiaal : leisteen - slate
@12 kleur : donker rood
@13 Aanduiding : -
@14 Korrelgrootte mu: ~ 5000 JIS
@15 Hardheid korrel : ~ 5
@16 Krasweerstand gram: 250
@17 Water /olie : water
@18 Soaking : nvt
@19 Structuur : zeer dicht
@20 Resultaat : *****
@21 Cutting Speed : snel
@22 Feedback : goed
@23 Lapping : regelmatig
@24 Slurry kleur : paars
@25 Lengte in mm : 227
@26 Breedte in mm : 50
@27 Dikte in mm : 19.7
@28 Gewicht droog : 606
@29 Gewicht nat : 607
@30 Opgenomen water: 1
@31 In procenten : 0
@32 Srt. Massa : 2.71
@33 Tekst : nr25. Speciaal voor ons gemaakt door Inigo Jones op 18 mei 2011. Inigo Jones & Co Ltd; Tudor slate works; Y Groesion; Caernarfon; Gwynedd; LL54 7UE. Betaald: 7,20 Euro







P-grit ruler

Waterproof sandpaper
Sandpaper is called plane-cutting tool.
Sandpaper comes in different grits.
A number, preceded by the letter "P", indicates the grain size. The number is the reciprocal (inverted) of the grain diameter in inches.
Abrasive paper P1000 thus has granules having an average diameter of 0.001 inch.

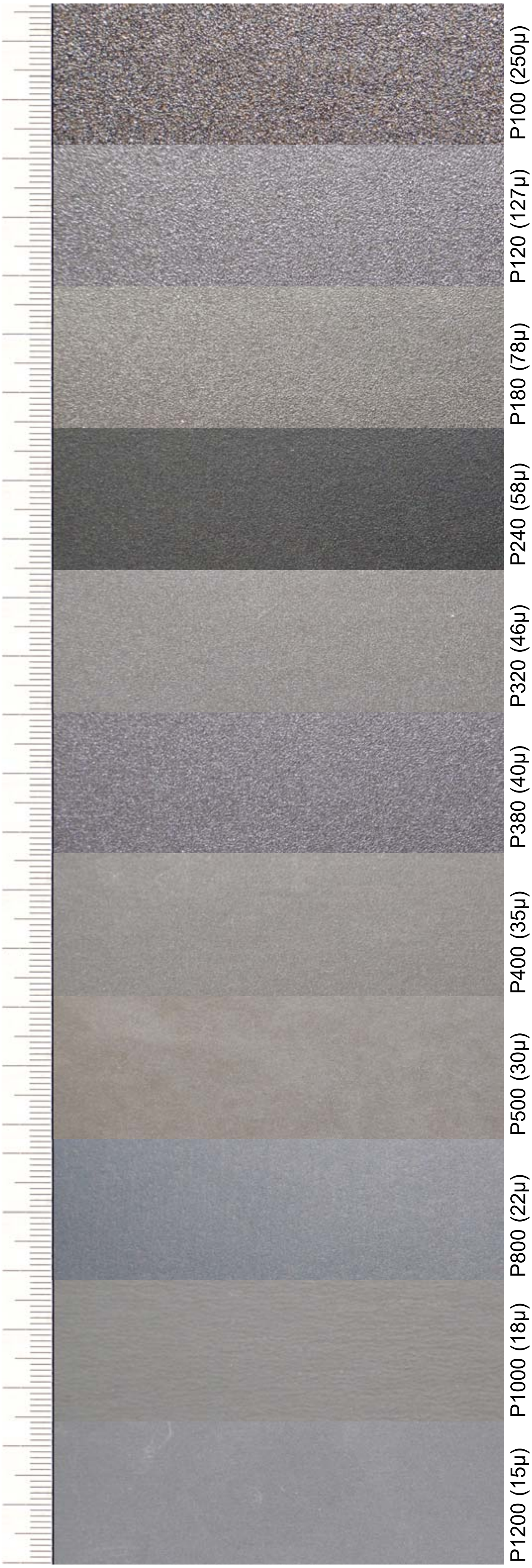
The next "P"sizes are common:
* P60, 250 µ, very coarse sanding.
* P100, 156 µ, coarse sanding.
* P120, 127 µ, coarse sanding.
* P150, 97 µ, rough sanding.
* P180, 78 µ, normal abrasion.
* P240, 58 µ, normal abrasion.
* P400, 35 µ, finer sanding.
* P500, 30 µ, finer sanding.
* P600, 25 µ, fine sanding.
* P800, 22 µ, fine sanding.
* P1000, 18 µ, very fine sanding.
* P1200, 15 µ, very, very fine. Use only for the best stones.
* P1500, 12.6 µ, fine sandpaper, especially for gel coat sanding.
* P2000, 10.3 µ, is used in e.g. car spraying. It is sometimes available at paint suppliers.
* P2500, 8.4 µ, the finest sandpaper that is available as far as I know. Is used e.g. for polishing.

See: http://www.politoeren.com/contents/nl/

Note: grit 1500, 2000 and 2500 sandpaper are made in smaller sheets (approximately 14 x 23 cm) by the manufacturer.

Waterproof
Leveling stones is preferably done with waterproof sandpaper because it is not so quickly filled with material from the stone.
This sandpaper does not tear when wet.
Further, "wet sanding" is significantly faster.

Making the stone level
Always make a pencil grid on the stone, so you can see whether the stone has become level after grinding.
Usually you start with a coarser grain than the grain of the stone, until all the pencil marks are gone. Then go on with increasingly finer grain until the grain of the stone is reached. If you save a phase, it becomes more work.
Do not especially start with too coarse waterproof sandpaper. That only makes deep scratches.



Waterproof sandpaper as it is in my collection. The images are put to scale on this page. Print the page so that the distance between the stripes corresponds to the distribution in mm on a ruler.















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